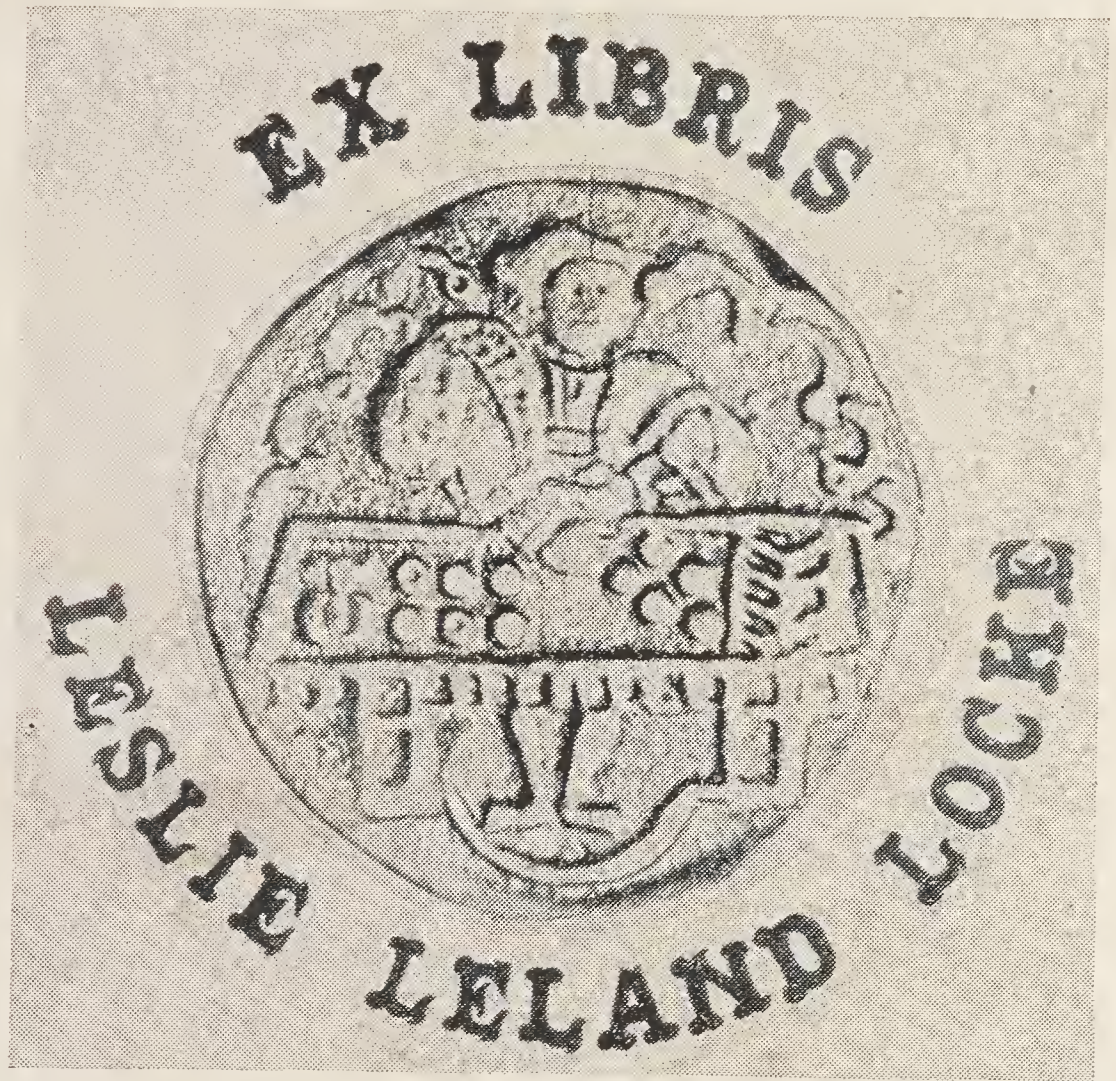


Surveying

Field

Wm Macdougall



MSS

001793 B

SCDIRB

Sept 14. 1899.

Prob. I To set pickets

First - set the pickets firmly in the ground, as near as possible plumb
Second - at a short distance from picket hold plumb line, make the picket parallel to plumb line
Repeat this operation at a point about 90° from first point.

Prob II To line over a hill; the two ends not visible from each other.

Selected S.E. corner of College Hall and N.W. corner post of New Women's Bldg. for points
First picket man set up his picket, then aligned the second. Second man then aligned the first and so on until both men were in line.



Less than 180° about 90°



Prob III

To line over a hill, by three men, the two ends not visible

Same method as Prob II

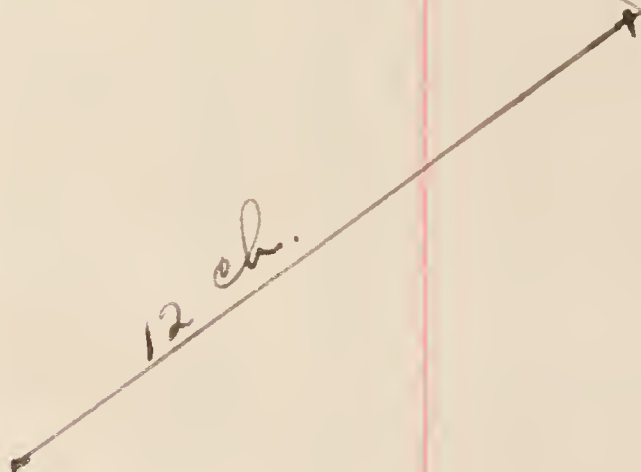
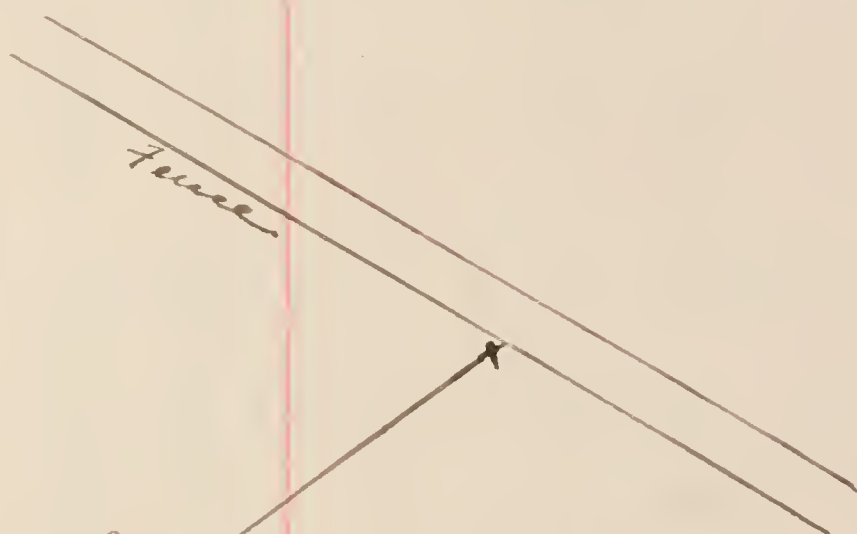
Prob IV

To chain a distance and check

Selected a post in the N boundary fence of the Campus and ran directly toward the S.E. corner of College Hall.

Found distance to be 12 chains

Check - Changed chainmen and returned over same line
Error was 3" too long.



College  Hall.

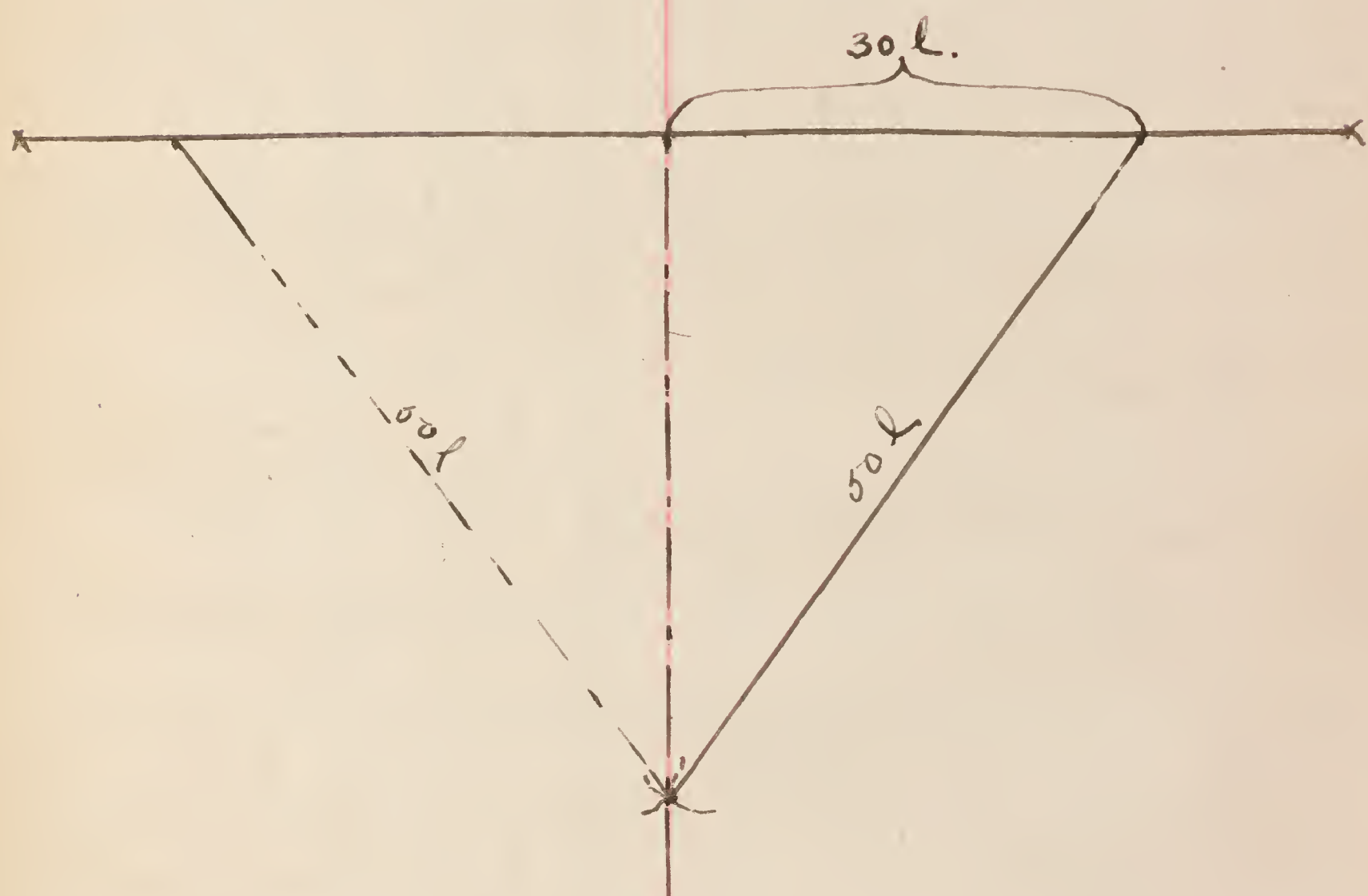
Prob V

To ~~make~~ mark points in line
in a ravine or valley.
Align a point across the
valley. Then align one point
in the valley from which
other points may be aligned

Prob VI
Sept 21. 19

At a given point in a line
to erect a perpendicular to the
line

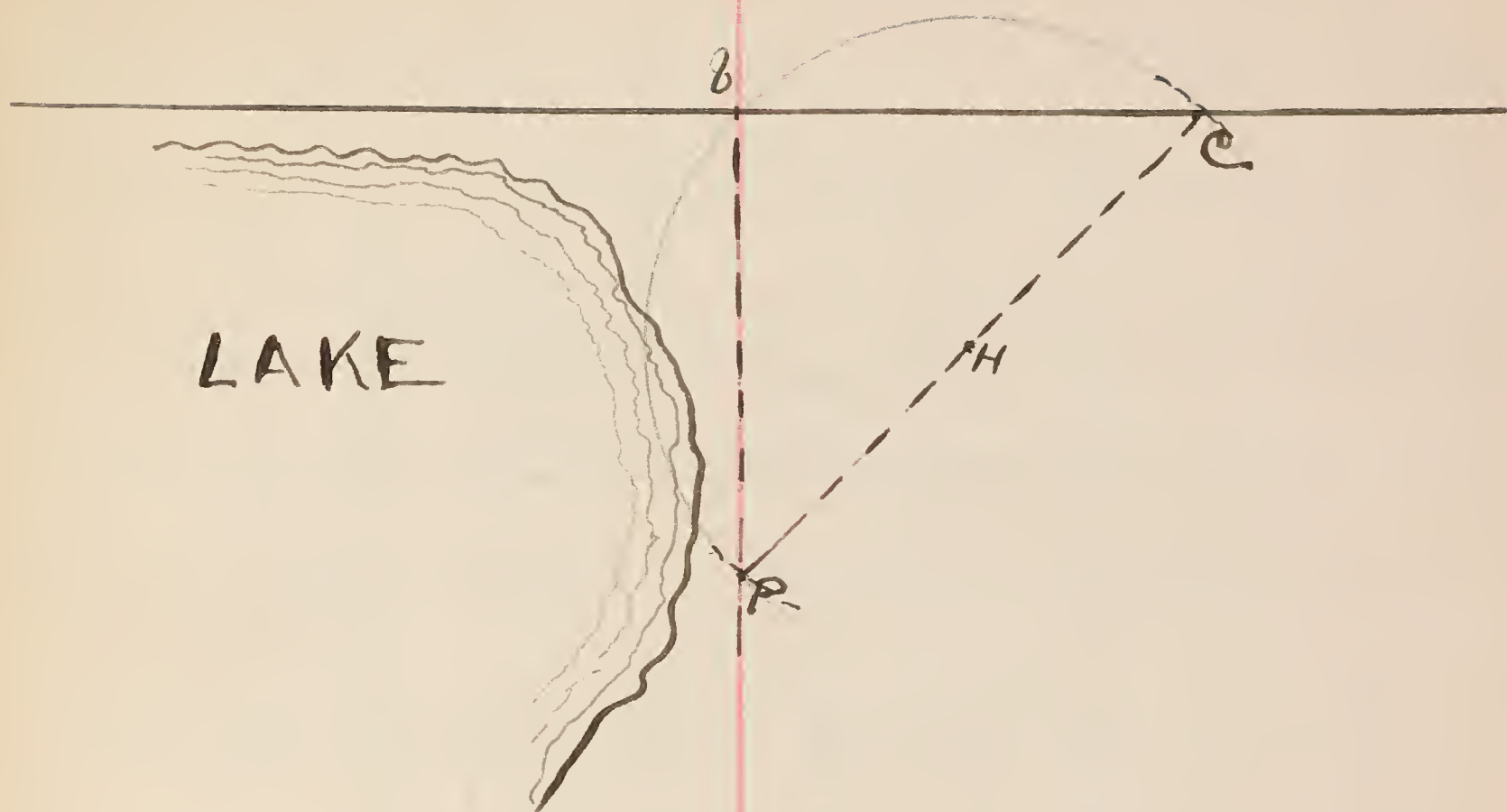
Measure off from the point
a given distance (30 c)
each way along the line
From these points strike
equal arcs. The intersection
will be a point on the perpendicular.



Prob VI
2nd method
Check on
1st method

The same point and line were taken. Then a point in front and to the right of the point in the line was chosen as the centre of a semicircle with a radius equal to bH . Thro the point C (the intersection of the arc and given line) and the centre of the circle a diameter was drawn. A line thro the point P and the given point on the line will be the required perpendicular. Because it being a $rt \angle$ described in a semicircle.

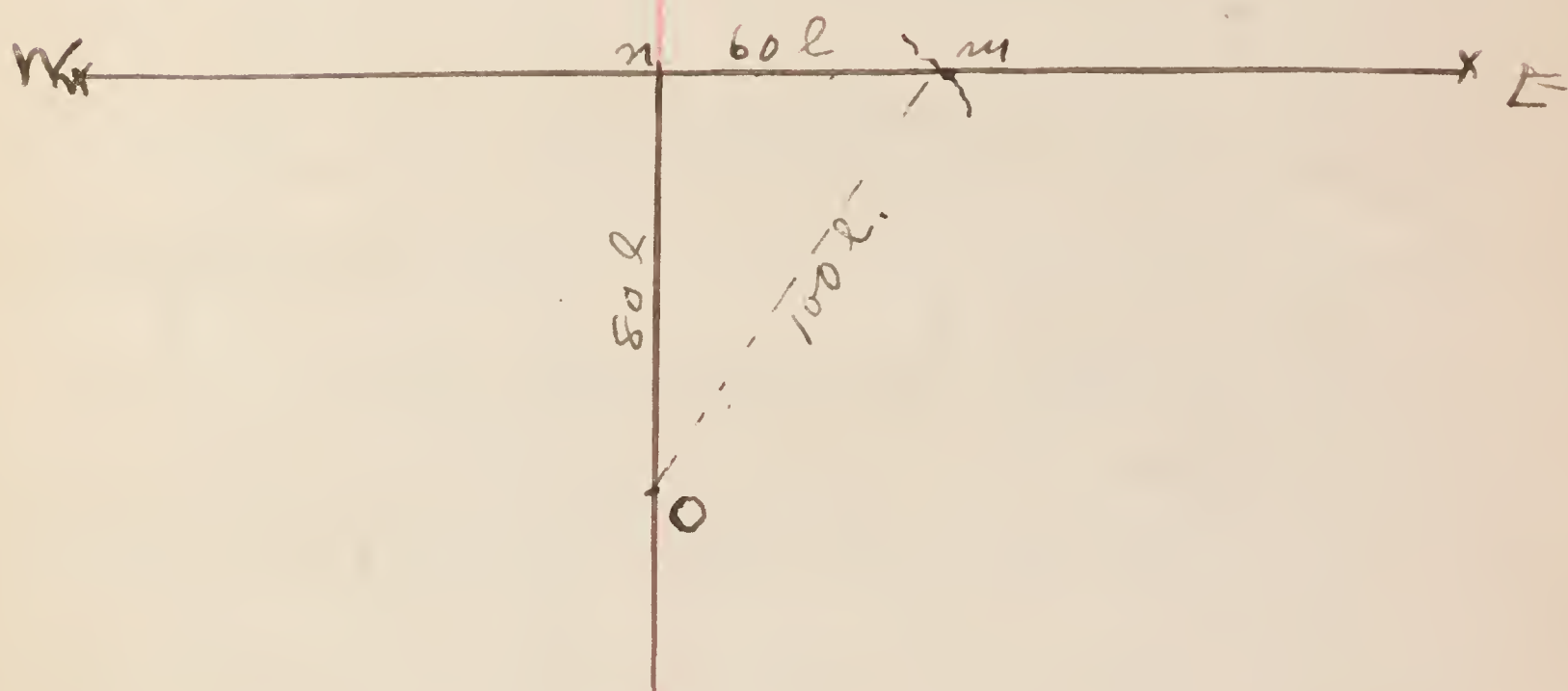
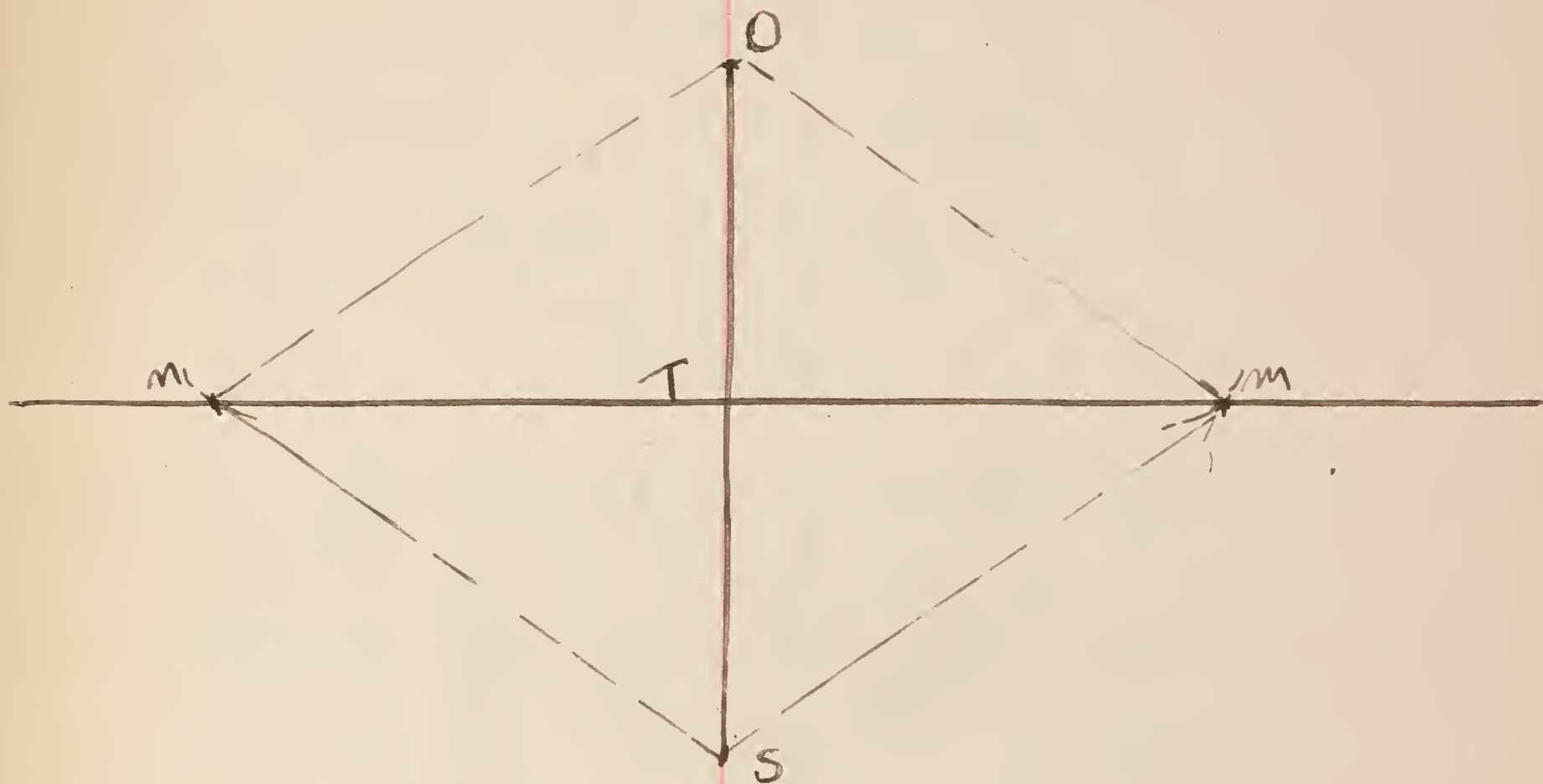
The error was two inches at the point P between the perpendicular drawn by these two methods.



Prob VII From a point without a line
let fall a perpendicular to the line

1st Method From the given point O with a
radius greater than OT strike
an arc, find the points where
it crosses the given line,
With these points as centers
and radii greater than OT
strike arcs. Find their points
of intersection a line drawn
thro the given point and the
last found point will be \perp
to the given line.

2nd Method From the pt O with a radius of
100 l (a multiple of 5) we struck an arc
which intersected the given line at m
from which point we measured back
on the given line 60 l (a multiple of 3)
the pt n should be the pt of our
perpendicular. It was found to
be $1\frac{1}{3}$ " east of our perpendicular as
determined by 1st method.



Prob VIII

To prolong a line thro' an obstacle.

Four stakes were driven into the ground to serve as an obstacle.

1st method

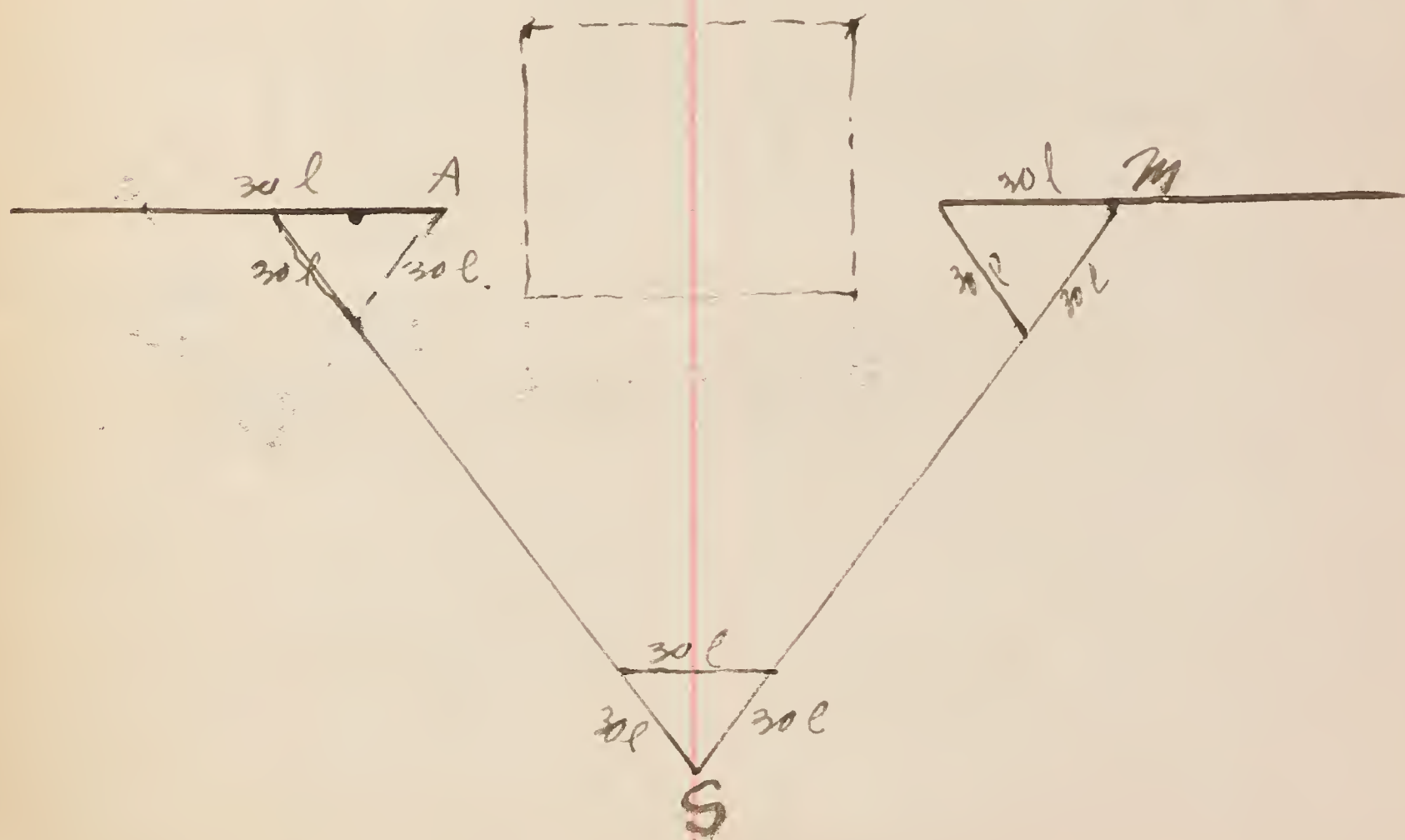
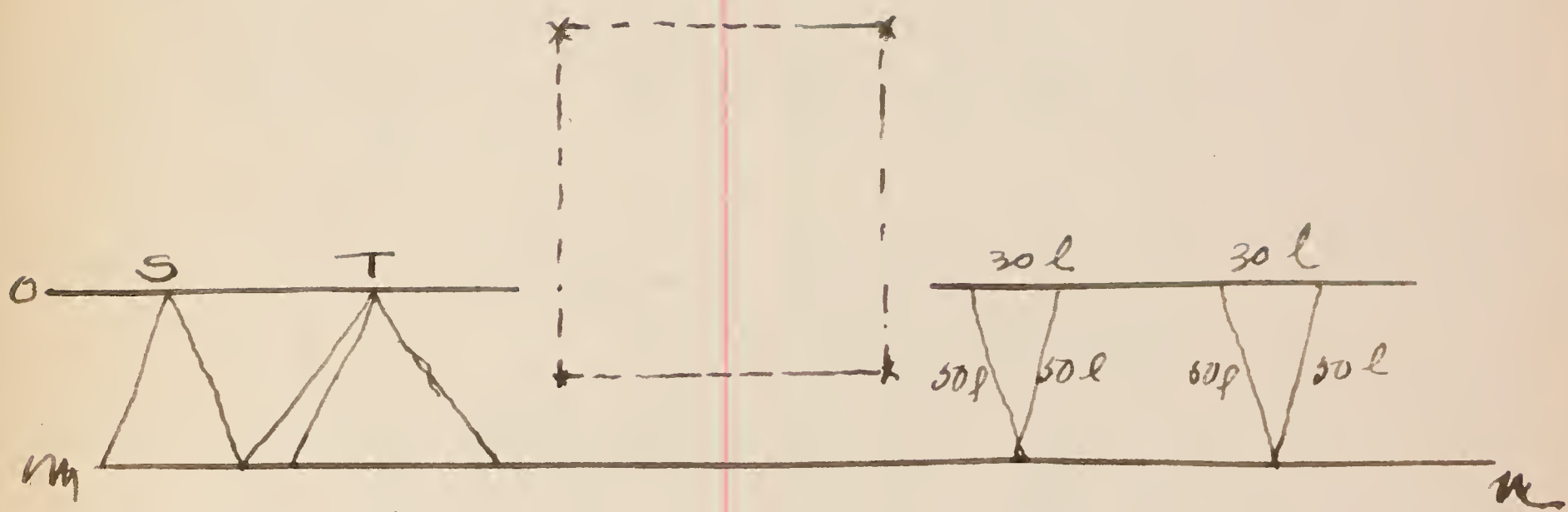
A line $m-n$ was run parallel to the first line by obtaining two points equally distant from the first (by making two equal isosceles \triangle the bases being 30 l and sides each 50 l

When the other side of the obstacle the two points S and T were obtained in the same manner no error.

2nd method.

On the first line before reaching the obstacle an equilateral \triangle was made (side = 30 l) The side $m-n$ was then prolonged 200 l (enough to clear the obstacle) to the point S. another equilateral \triangle was formed and the side OS made equal to mS .

another equilateral \triangle was formed that two pts O and A might be obtained At the point O an error of two inches



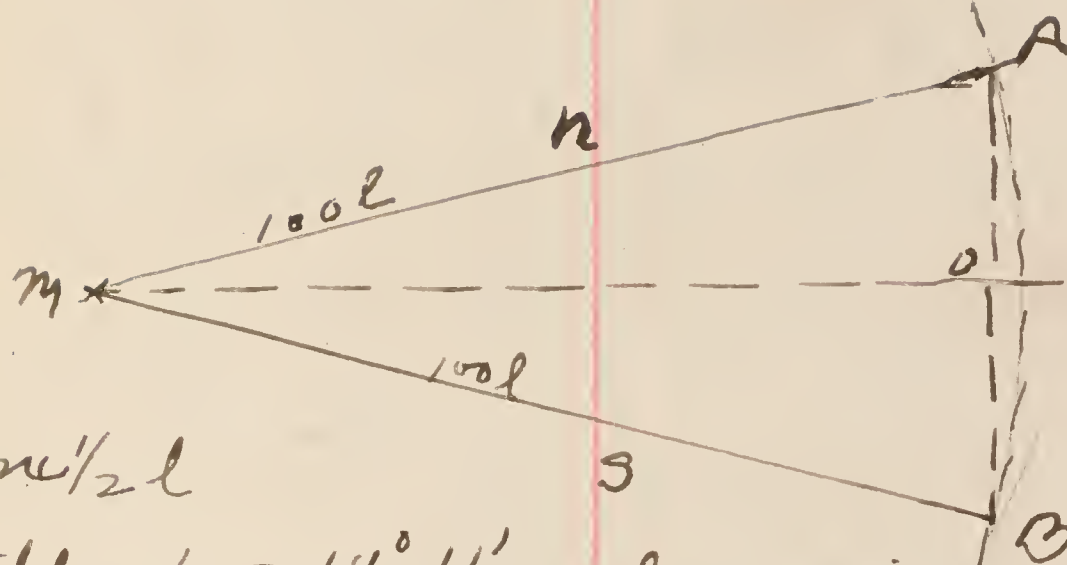
(2") was found from the true line as sighted across the marked out square, which had not before been sighted across.

Prob IX

To measure a given \angle with chain and pins.

Let m be the vertex of \angle formed by lines passed thro N and S.

With a radius of 100 lbs strike arc so as to intersect the sides of \angle , measure chord, take one half. find angle in tables which corresponds to the sine of $24\frac{1}{2}$. Mult this \angle by two as $24\frac{1}{2}$ is sine of $\frac{1}{2}$ the \angle . The angle was found to be $28^{\circ} 22'$.



$$\text{Chord} = 49 l$$

$$\frac{1}{2}'' = 24 \frac{1}{2} l$$

$$\text{Sin} = 24 \frac{1}{2} l$$

From tables $L = 14^{\circ} 11'$ where sine is $24 \frac{1}{2}$

$$2 \times 14^{\circ} 11' = 28^{\circ} 22' = \angle AOB.$$

Prob IX

At a given point on a line lay off an ^{given} angle.

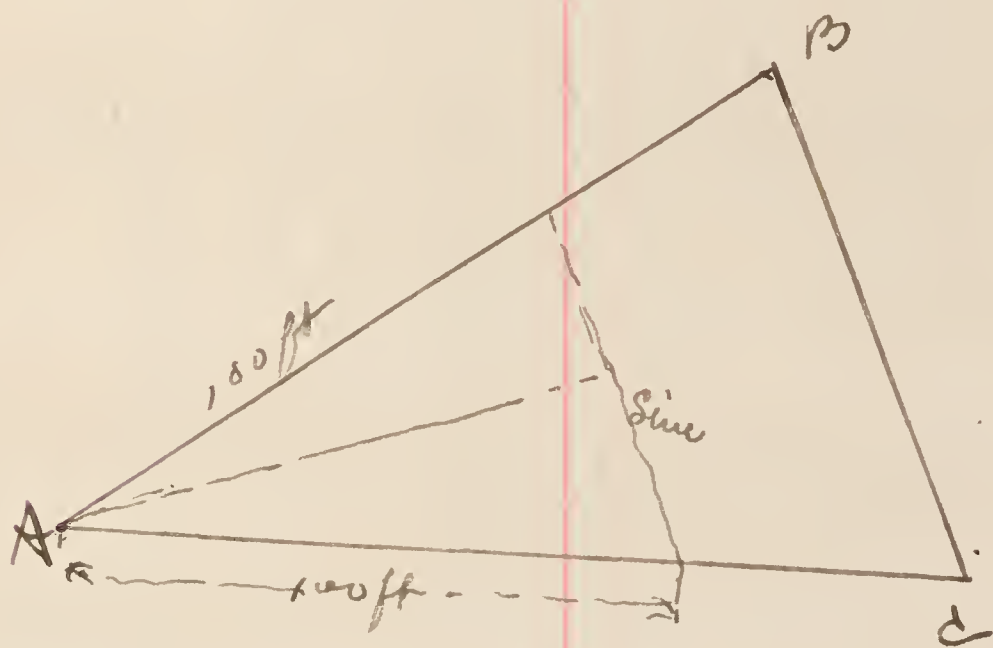
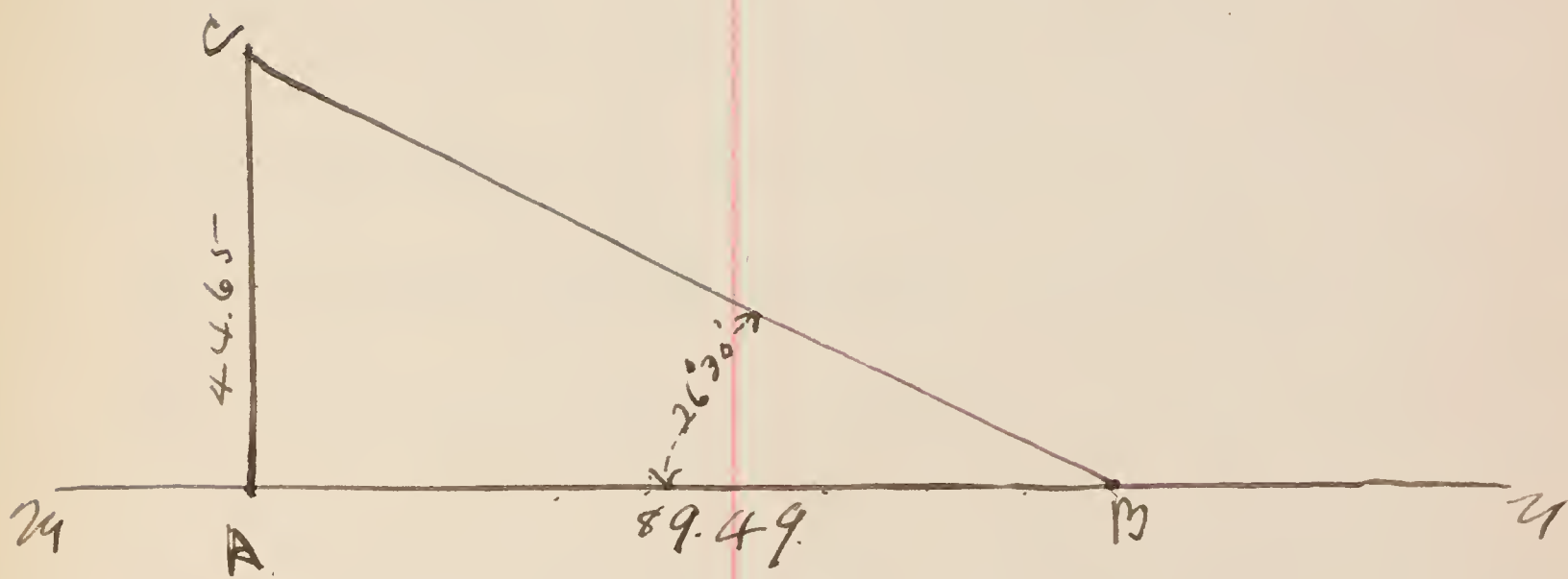
To lay out angle of $26^{\circ} 30'$

Let B be the given point
 Run ~~now~~ m n lay of BA = b -
 cosine of $26^{\circ} 30'$ (when $r = 100$ ft)
 which is 8949. At A erect \perp
 and lay off on same a distance
 equal to sine of given angle. Then
 CBA will be required angle.
 As a check we measured
 the hypotenuse and found
 it to be 2" too short.

Prob XI

To place three stakes and measure
 the angles. Check. sum = 180°
 Angle A. Measured 100 ft along each side
 then distance across $110\frac{3}{4}$ ft.

$$\begin{aligned} \frac{1}{2} \times 110\frac{3}{4}' &= 55.375 = \sin LA \quad LA = 33^{\circ} 22' \\ \frac{1}{2} \times 116\frac{7}{8}' &= 58.875 = \quad \quad \quad LB = 35^{\circ} 45' \\ \frac{1}{2} \times 71\frac{1}{8}' &= 35.562 \quad \quad \quad LC = 20^{\circ} 50' \\ A &= 66^{\circ} 44' \quad B = 71^{\circ} 30' \quad C = 41^{\circ} 40' \\ \text{check } &199^{\circ} 54' \end{aligned}$$



Prob XII

With chain, pins, and pickets
lay out rectangle $1\frac{1}{2}$ chs N and
2 chs E of NE corner of College Hall
Rectangle to be 75' x 100' and
sides parallel to sides of College
Hall. Long sides to run N & S

Prob XIII

To test the compass.

Set up instrument E of College Hall
Placed the legs firmly in the ground
with plate as nearly as possible
adjusted plate until it was level.

Test needle

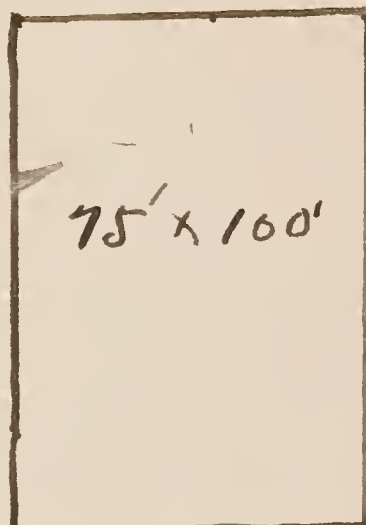
Test needle for curvature.
Found place where points of needle

College
Hall

$1\frac{1}{2}$ chs.

2 chains

75' x 100'



read 180° apart.

Turned instrument half way around. Points were still 180° apart.

Test center.

Test for pin in center of box.

Turn box 90° needle reads 180° apart

" " 270° " " " "

Test sight for parallelism and perpendicularity

Hang plumb-bob from College Hall window. Sighted slit at bob line reversed and sighted again both were in line.

Instrument is correct.

Prob. XII

To run a line with out back sight.

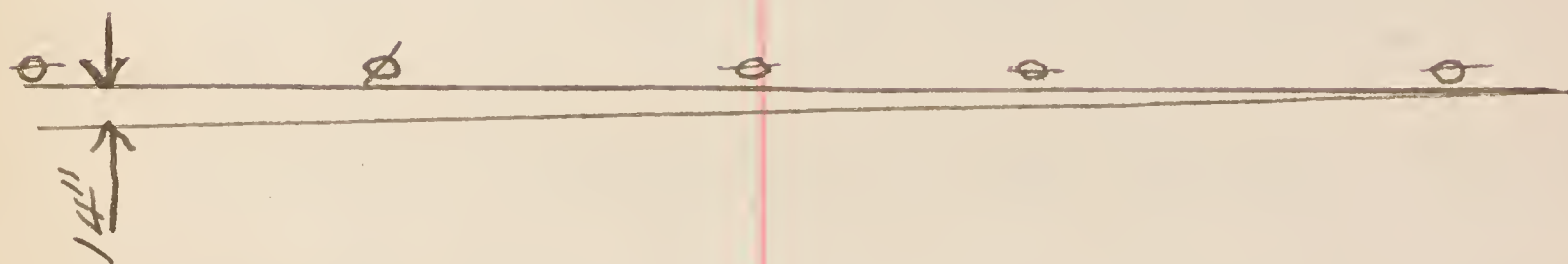
Set up Compass N.E. of College Hall.

Run line in direction of Sec. Bird's House.

Returned.

Result $14''$ to E on four stations

Line run was $N 12\frac{1}{2}^\circ W$.



Prob XV

Given A.B. on opposite sides of an obstacle. To find distance AB and to place pins 50 ft apart along line AB.

Laid off line AC. From B with radius of 100 ft struck arc intersecting AC at a' and b'. From a' and b' with radius of 80 ft struck arcs intersecting at c'. Then line CB is perpendicular to AC.

Found CB to be 88.5 ft long
A.C. found to be $210\frac{3}{4}$ ft long.

$$\text{Computed } AB = \sqrt{(88.5)^2 + (210.75)^2} = 228.58$$

Found AD must be 46.1 ft to make
AE = 50 ft and DE = 19.36 ft.

$$FG = 38.72 \text{ ft.}$$

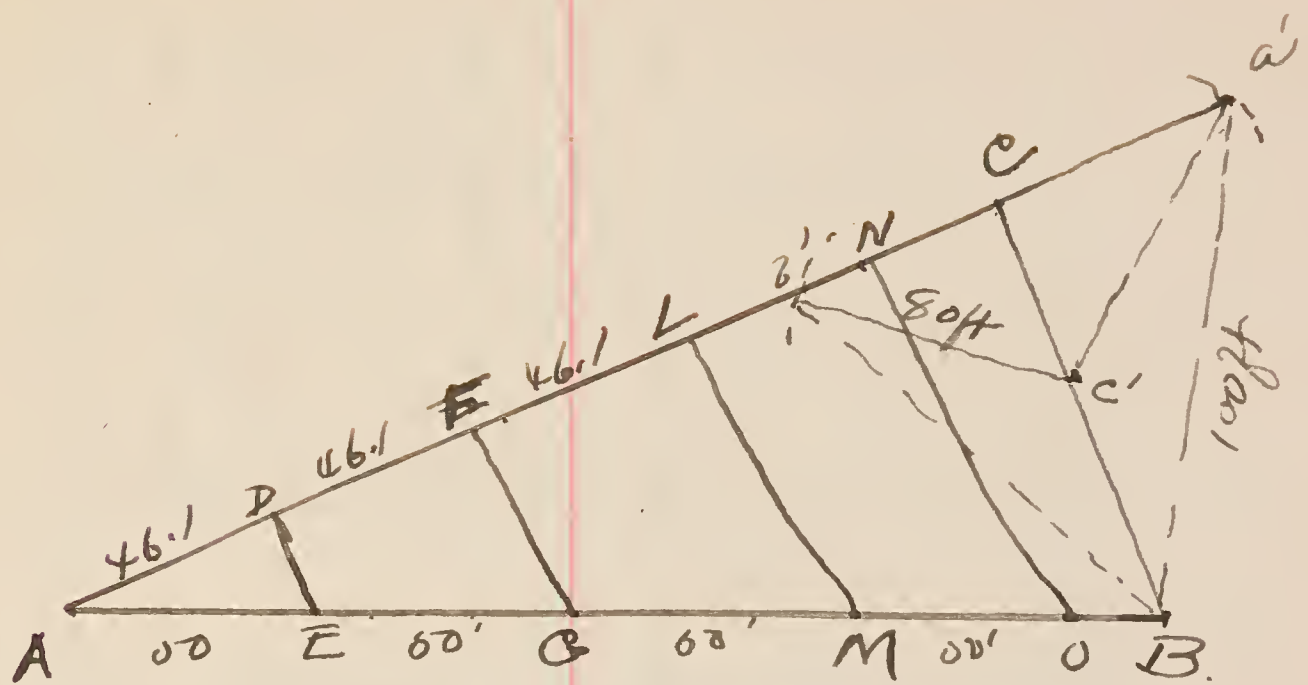
Errors.

Pin at O was 3" out of line

AE was 50' AO was 200' 4"

AG " 100' 1" AB " 228' 8"

AM " 150' Error on AB = .96 inches



Prob XVI To measure the three angles of a triangle with a compass.

BA was $S 9^{\circ} 30' W$ $\angle ABC = 33^{\circ}$

BC " $S 42^{\circ} 30' W$

CA " $S 45^{\circ} 30' E$ $\angle BCA = 91^{\circ} 30'$

CB " $N 43^{\circ} E$

AB " $N 9^{\circ} 30' E$ $\angle CAB = 54^{\circ} 30'$

AC " $N 45^{\circ} W$

check $33^{\circ} + 91^{\circ} 30' + 54^{\circ} 30' = 179^{\circ}$
error was one degree

Oct 26 - 99

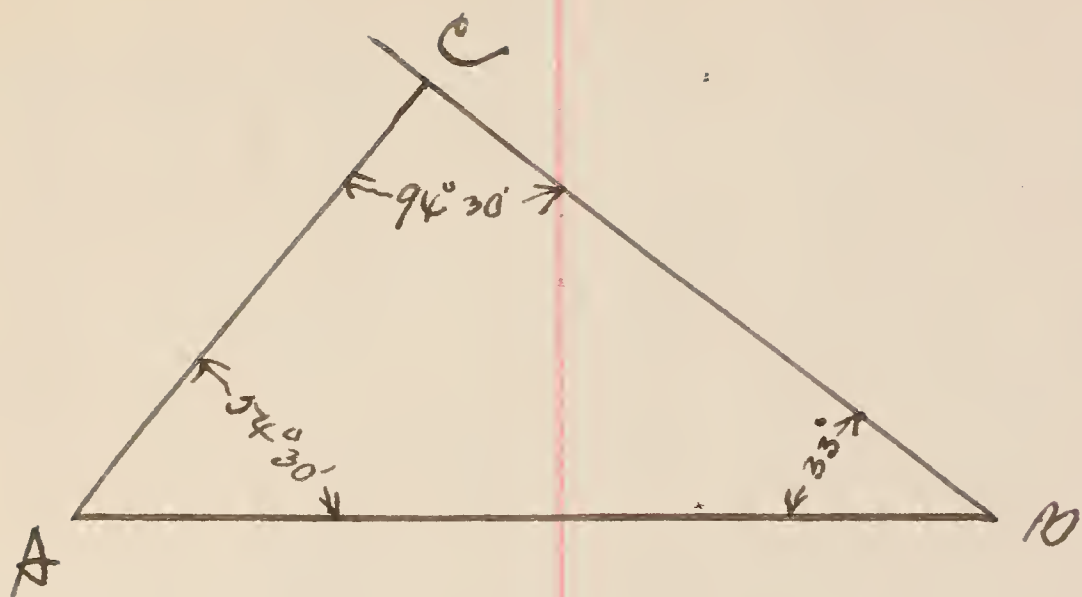
Sta A. $\left\{ \begin{array}{l} AE S 17^{\circ} 45' W \\ AB S 89^{\circ} 15' E \end{array} \right\}$ 4 ch 64.4

Sta B $\left\{ \begin{array}{l} BA N 89^{\circ} 15' W \\ BC S 15^{\circ} W \end{array} \right\}$ 4 87.4 $\left\{ \begin{array}{l} N 89 W \\ S 15^{\circ} 15' W \end{array} \right\}$ 4 87.

Sta C $\left\{ \begin{array}{l} CB N 43^{\circ} E \\ CD S 35^{\circ} 10' W \end{array} \right\}$ 2 40 $\left\{ \begin{array}{l} N 15^{\circ} 15' E \\ S 35^{\circ} W \end{array} \right\}$

Sta D $\left\{ \begin{array}{l} DC N 35^{\circ} 10' E \\ DE N 70^{\circ} 45' W \end{array} \right\}$ 3.95 $\left\{ \begin{array}{l} N 35^{\circ} 15' E \\ N 70^{\circ} 45' W \end{array} \right\}$

Sta E $\left\{ \begin{array}{l} ED S 71^{\circ} 45' E \\ EA N 17^{\circ} E \end{array} \right\}$ 5.75



Interior angles of survey.

Angle at A	106° 41'
" " B	75° 47'
" " C	160° 24'
" " D	105° 59'
" " E	91° 9'

Nov 2 1899.

W. J. Bailey - note keeper.

Sta B.

△ B (stake driven back)

Began at sta. B. on the reserve. Tied sta B. to
N.W. corner Agri. Lab. $N 46^{\circ} 40' E$ 128.7 ft. also to N.W. corner
of cattle barn (across building) $S. 56^{\circ} E$ 59.9 ft.
Also tied Sta B. to pine tree 18" dia $N 73^{\circ} W$ 1.7 chains

N.W. cor of
cattle barn
main building

59.9

AB

170.

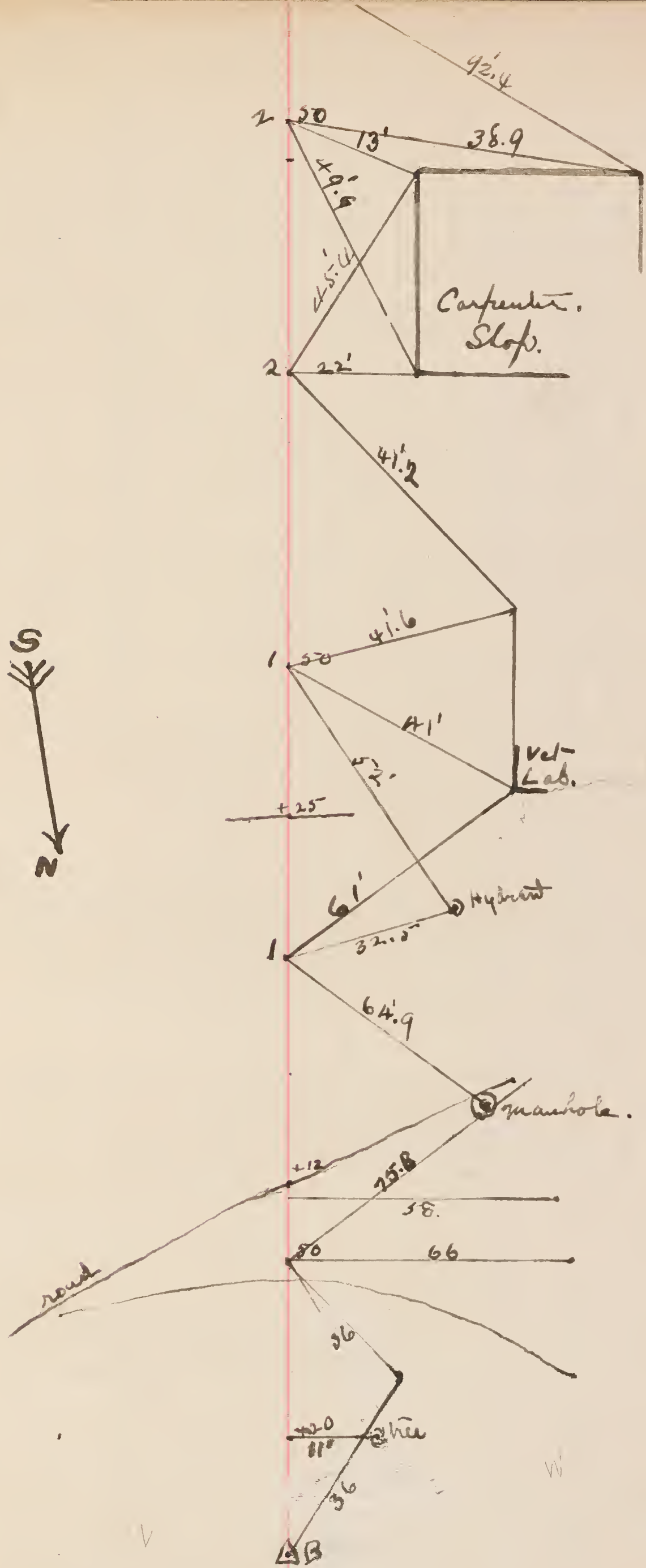
128.7

12

N.W. cor
Ag. Lab

current walk crosses at 125'

0 manhole.



92.4 to S.W. corner Computer shop.

telegraph pole.

4.

+ 16

3 50

140.7

120.

3

92.4

2' pole

245

2

50

124.9

127.6

Black
Smith
Shop.

Clear fine day. Nov 9 1899.

A. to B. 464.3

Passed road 4 ch. 3 lines 12 ft wide

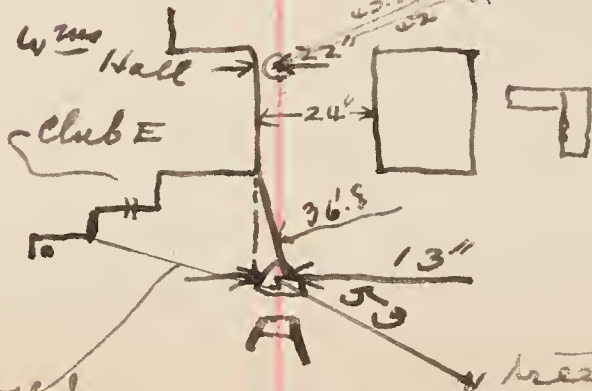
* Passed Cedar tree 2.85, 12 to right.

3rd Maple 28 to S.E. of 1st 17 from 2nd small cedar. 9 S and .4 E of walk
1.68 to ft of \perp at Y of walk Maple tree 66, 2nd tree 101.5 to S.
Middle of walk 1.525, 3' wide Y of walk 22.2 right

Crossed road 80 ft, 15 ft wide. To manhole from 150 chs 49' post 42
(manhole 6 ft square)
To corner near Club E Door N 21° 28' E 55 ft.

ΔA to S.W. corner W $\frac{200}{1}$ Hall N 88° 30' E 36.8 ft To tulip tree S 29° W 53 ft

N ← S 68



Mich.
Lab.

N 21° 25' E 55'

From C to A $N 17^{\circ} E$ angle of line from middle of bridge
also Sta = $N 63^{\circ} 00' E$

Included angle of auxiliary line + CA = $46^{\circ} 00'$

From Sta C to Boiler House = 214.5 line struck 23.8 from N.W. cor.
Boiler House
(at 170 ft to switch = 15 ft) at 140 = 21 (at 160 = 27.2" and frog)
at 180 = 33' at 200 = 53.6

Main track record

at 170 ft main track = 16.9 at 140 = 24.6 at 160 = 32.7
at 180 = 44.5 at 200 = 53.6

At 60 S track is 26" at 80 is 6. lbs 10 of S rail, at 100 is 11 ft at 76 ft
the switch is 11 ft from line (This is the switch target).

line crosses S track at 40 ft from station

at Sta. S rail is 3' 4" from station

at 1 ch. from bridge track is 3' 10" at 20 ft from bridge is 3' 7" at 40 ft
is 2' 3" at 60 is 3' 6" at 80 ft mark is 3' 11" at 100 ft from bridge is 3' 10"

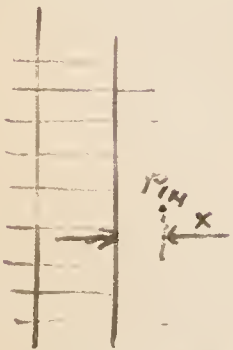
To middle of end (center) of R.R. bridge $S 63^{\circ} 40' W$ 1.146 track is 4' 8 wide

Find Sta E to S.E. corner of small long brick bldg back of Wells Hall
 $N 24^{\circ} 0' W$ 1.225

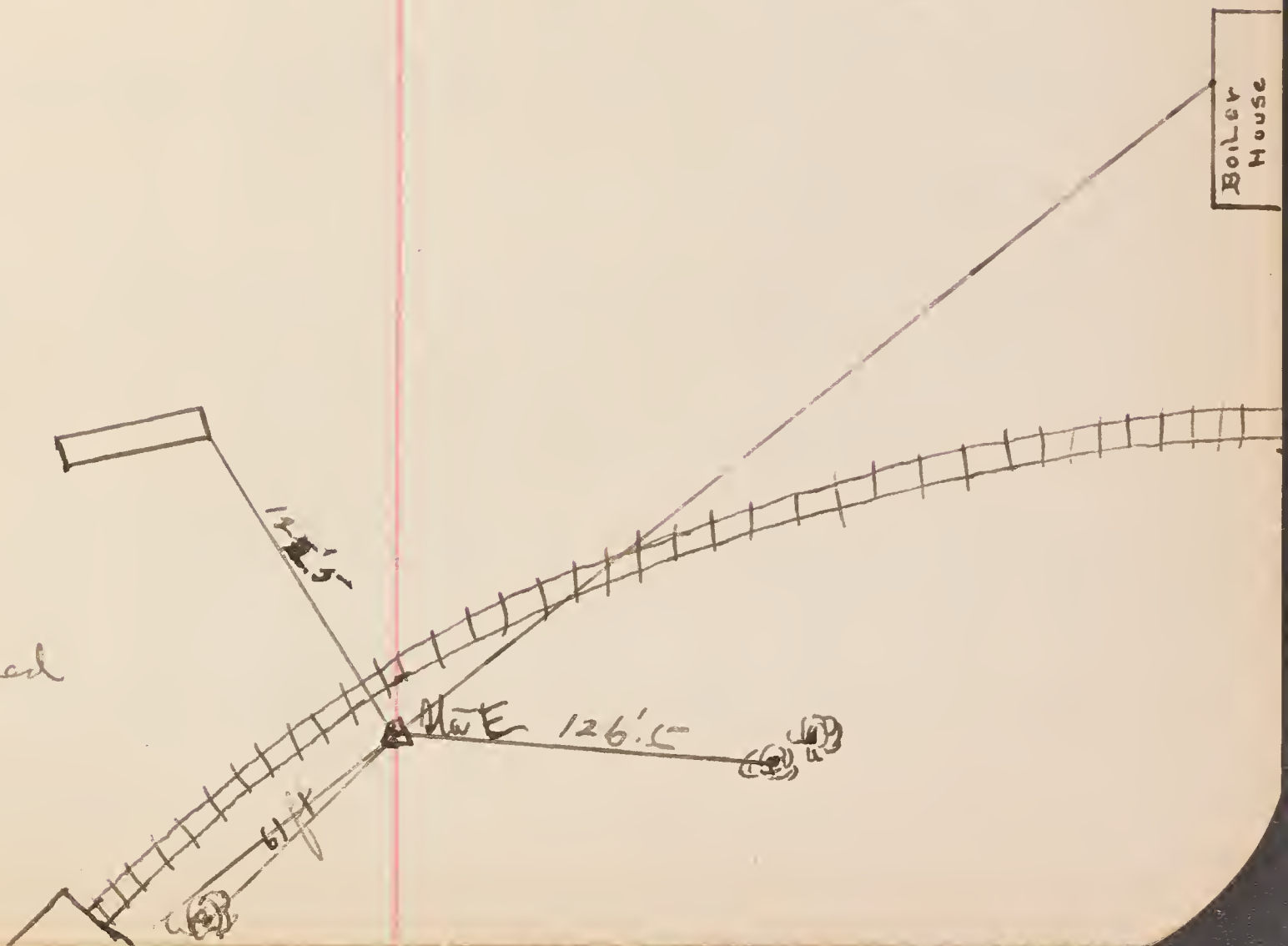
Find E to (N.W. tree) maple $S 35^{\circ} W$ of Sta 61 ft 18" dia

Find to 3rd tree SE of Sta 1.265 $S 60^{\circ} 20' E$ 16" dia

All measurements -
 to south rail of track
 and to inside of rail



x - length recorded



Nov 13. 1899.

Wolke - Dear.

Found deviation of needle to be $15'$ to West.

South track crosses line CD at 30 ft from C

Track 140 ft east of K and 453 ft from H (west line of boiler house)

(at 20 ft E of H^H is $3'11''$ to S rail and 18.5), (at 40 ft is 6" and 20.8)

(at 60 ft rail is 3' ft south and 21.8

manhole is 21' ft from 40 ft pin and 26.5 from 80 ft pin

at 80 ft pin S rail is 5.5 south of pin and 22.7 N

at 100 ft is 7.3 south of pin and 23.3 N. At 120 is 7.9 S and 23.2 N.

at 140 ft pin, is 6.9 S and 22.7 N.

at 160 is 5.4 S and 22' N at 180 is 3.5 S and 21.5 N

at 200 is 1.6 S and 21 N

S track crosses auxiliary line at 210 ft and 20 to N track

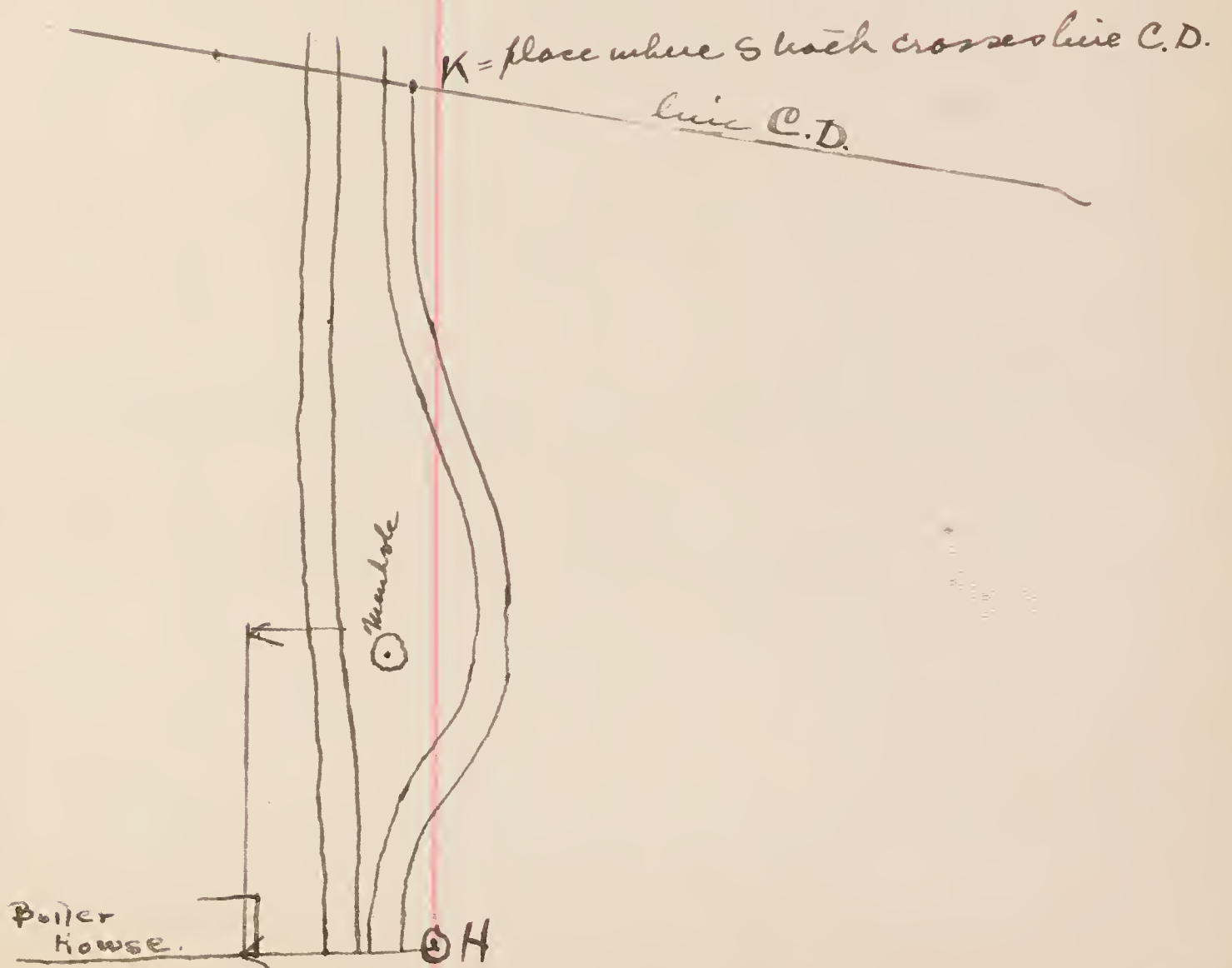
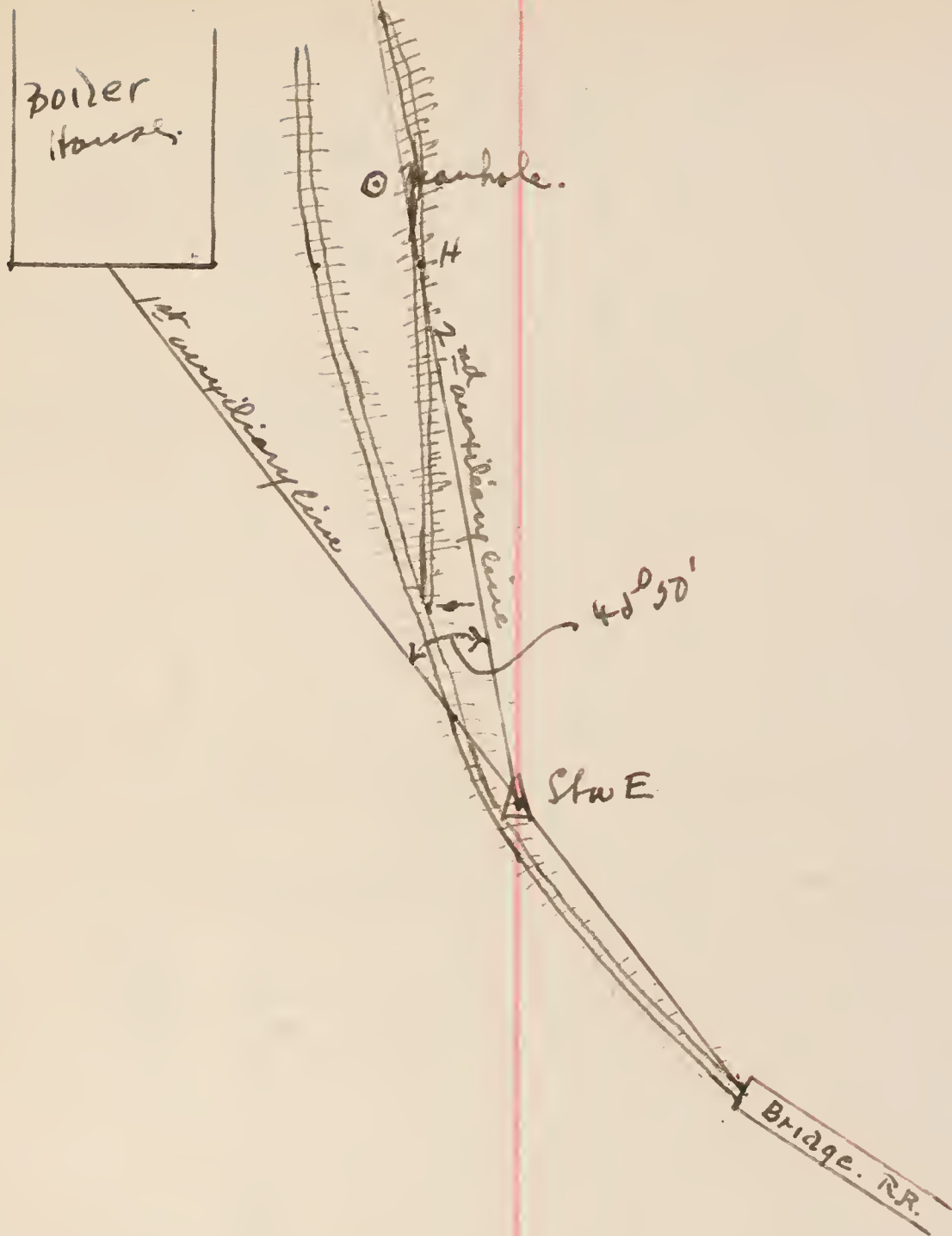
at 240 is 1.6 and 20.7 to North at 260 is 1.2 S and 20.3 N

at 280 is 2.4 S and 20' N

Through H^H E and point 100 ft south of boiler house

Upho ~~so~~ were driven 20 ft apart. from point where auxiliary

line strikes boiler house to where auxiliary line is 62.9 ft



Nov 13. 1899 Clear day. Note Kufw. D Mas.

197 ft to river from 200 ft pin.

line crossed road to ice house 197 ft from Sta D 10 ft road

S.W. Cor. Ice House $S 72^{\circ} 20' W$ 186.8 ft

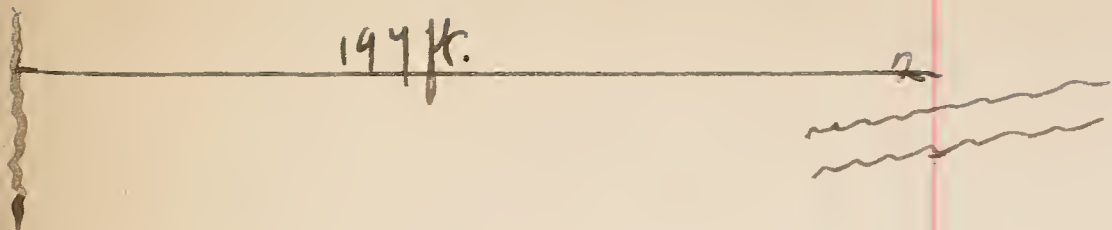
line crossed $6\frac{1}{2}$ ft road. 130' pin in middle of road.

W. a drive well 5" pipe 50.5 ft from Sta D $N 45^{\circ} 00' W$
F. line crossed a fence at 36' from Sta

295 ft from Sta D to river.

Δ Sta D Pin stake flush.

From Sta D to NW Corner Ice house $N 39^{\circ} 40' E$ 116 ft.



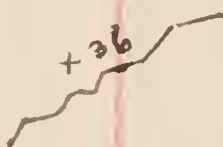
ICE
HOUSE



186.8 ft.

1.

.50



50.5

0.11

275'

A.D.

116 ft.

NEW
House.

Sta E to Sta D = 395.1 ft.

164 ft from line to Cedar River.

86.6 to NW cor. Ice house Ice house is 60.5 x 20.5

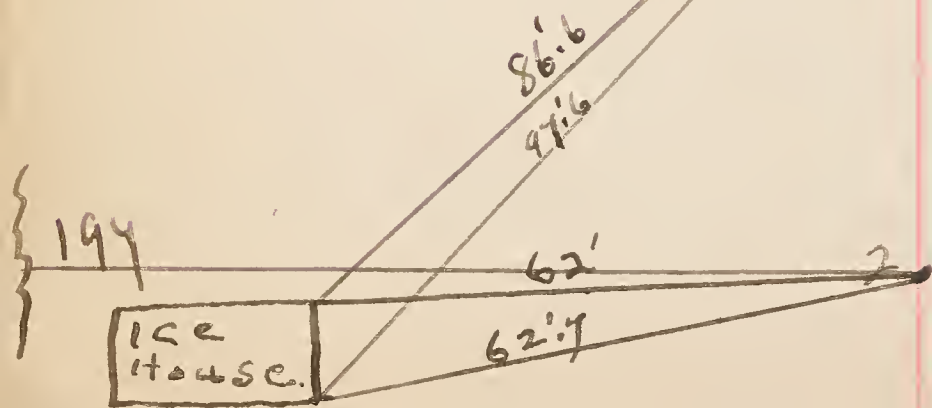
97.6 to N.E. cor. Ice house
199 ft to ruin - down at end of off set.

4.



3.

50.



Nov 23 1899.

Little Notekupur.

3 ft cement walk. crossed line.

10 ft road crossed line.

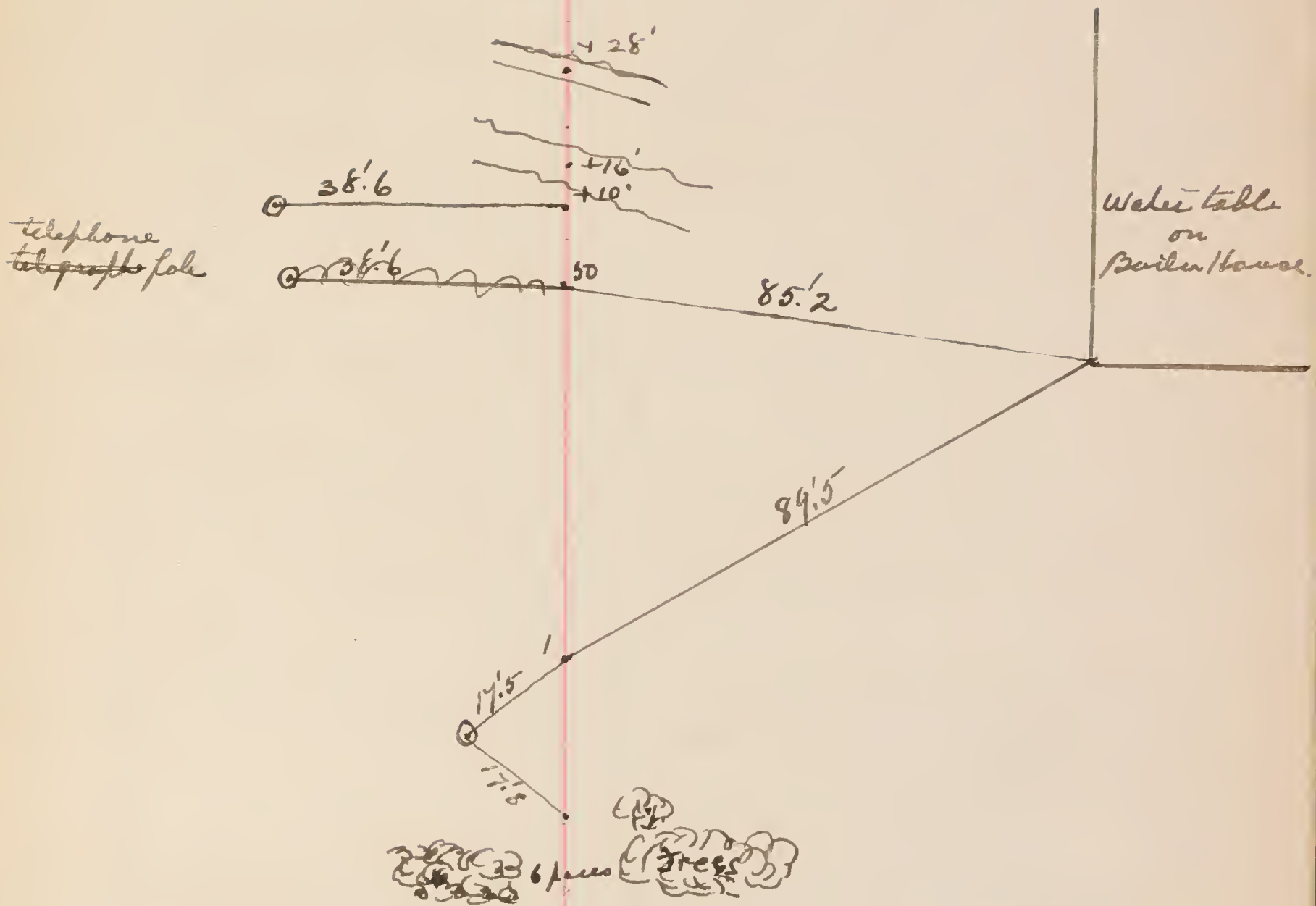
telephone pole 38.6 ft from line.

manhole.

Sta Δ X

Sta X is 216.8 ft from Sta E on line EA. Interior \angle is $104^{\circ} 55'$

7.

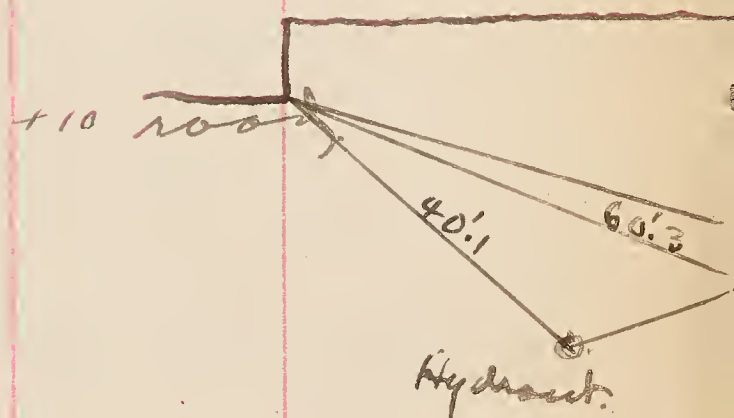


N ← S

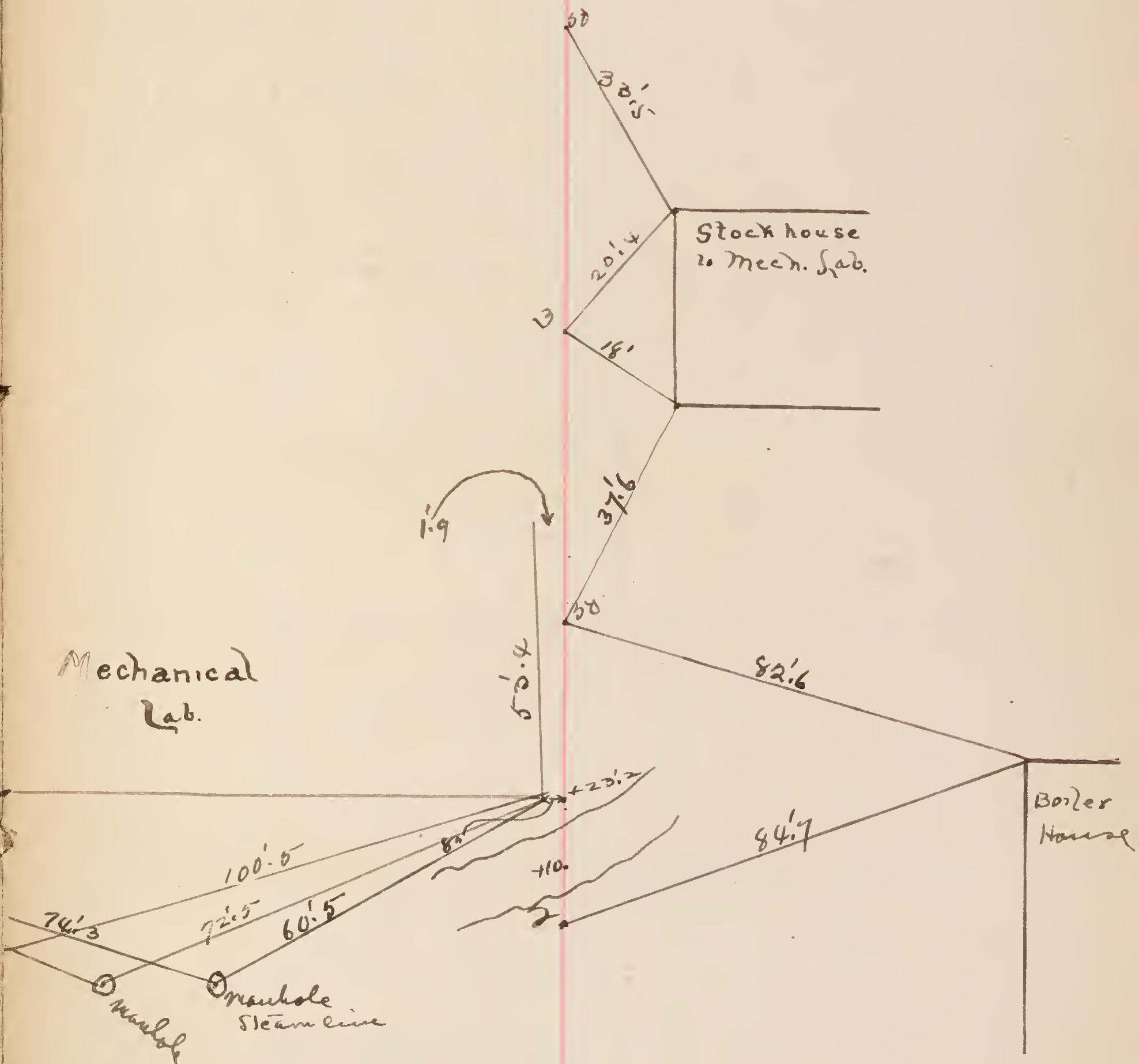
104° 55'

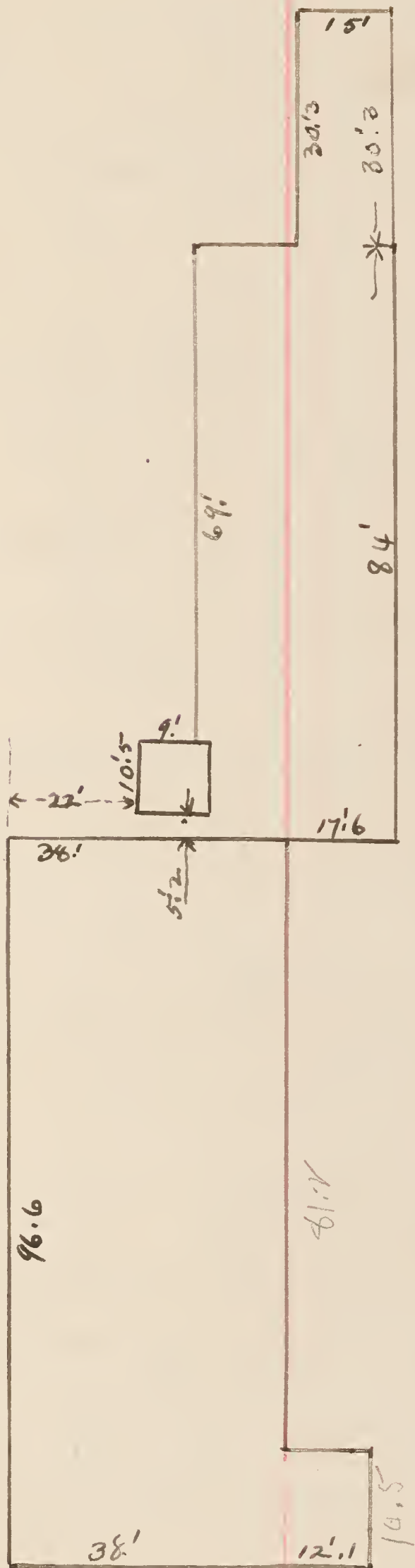
← E

S.E. cor. Mech Lab is 22" from x line
S.W. cor Mech Lab is 8' from x line.

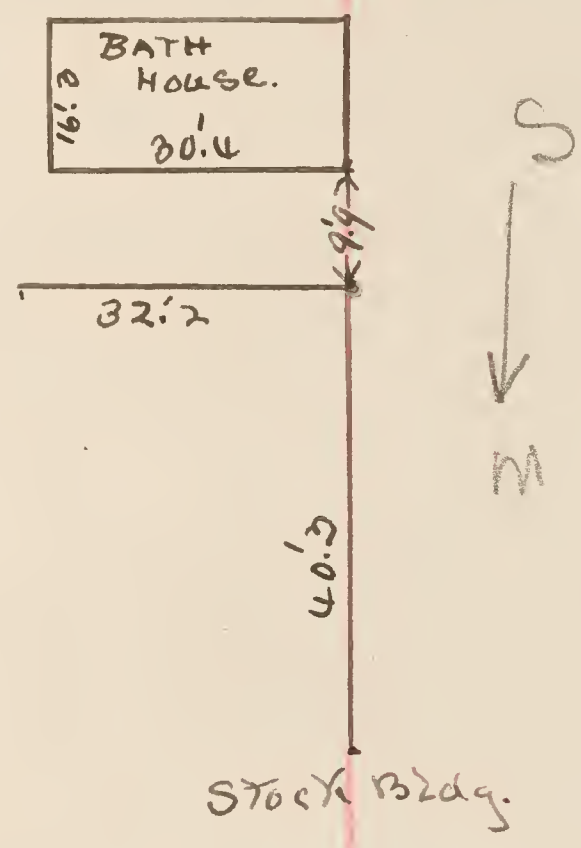
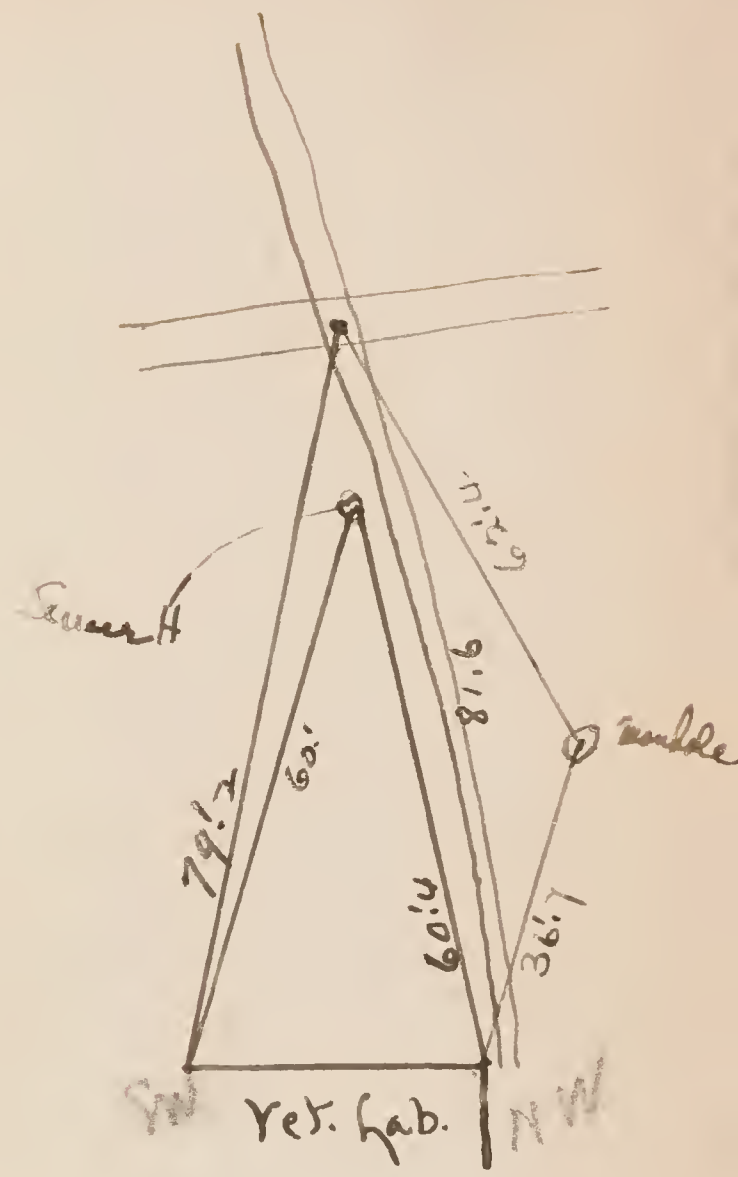
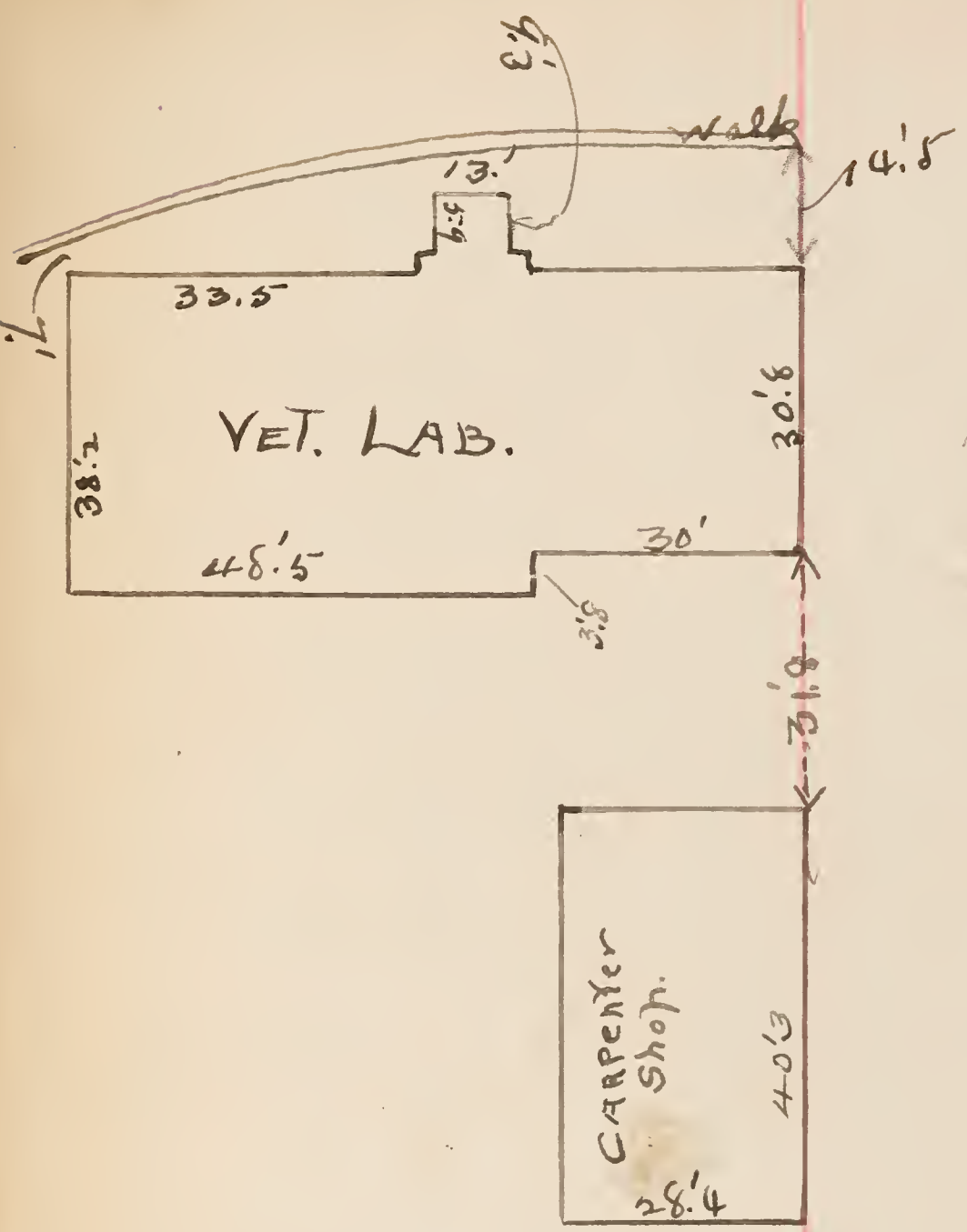


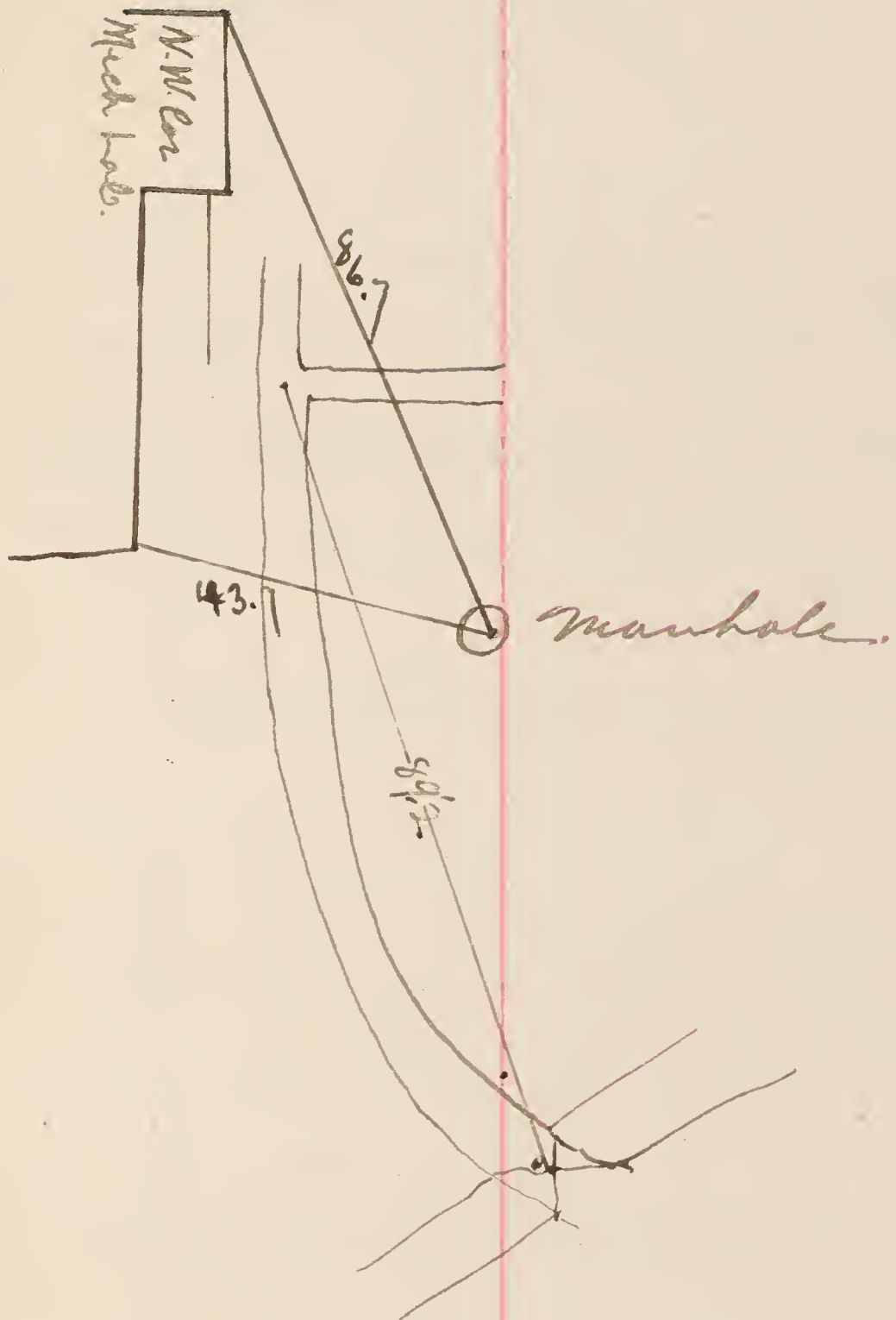
4.





Boiler House.





From ~~Scout's~~ notes

Station D

Well 57.6 from D and 59.5 from 200

SE cor. store house 46.4 from 200 and 71 from 150

NE cor store house ^{and 58 from D} 52.9 from 200 and 55.3 from 150

SE cor Quener Pig House 57.2 from 150 and 93.8 from 100

NE cor " " " 59.2 from 150 and 58.6 from 100

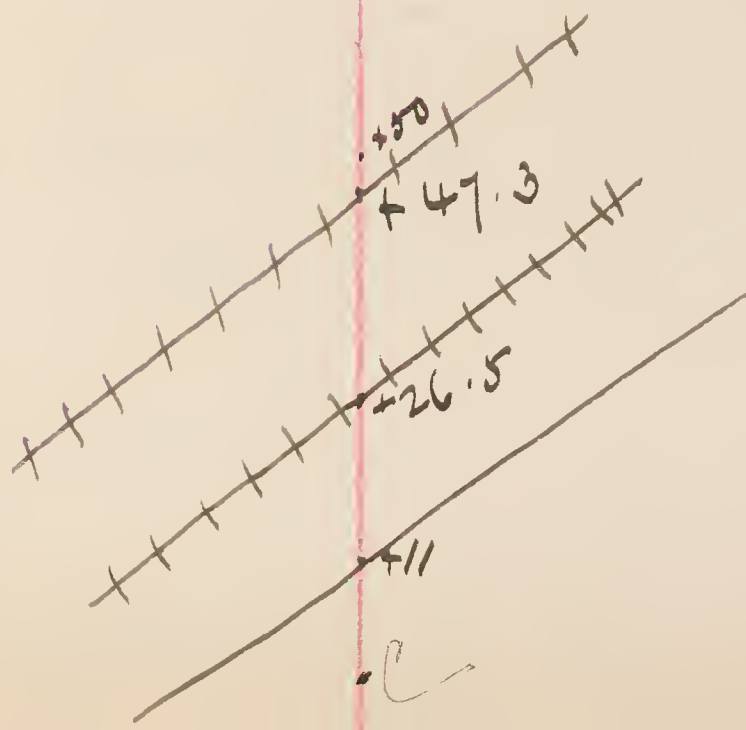
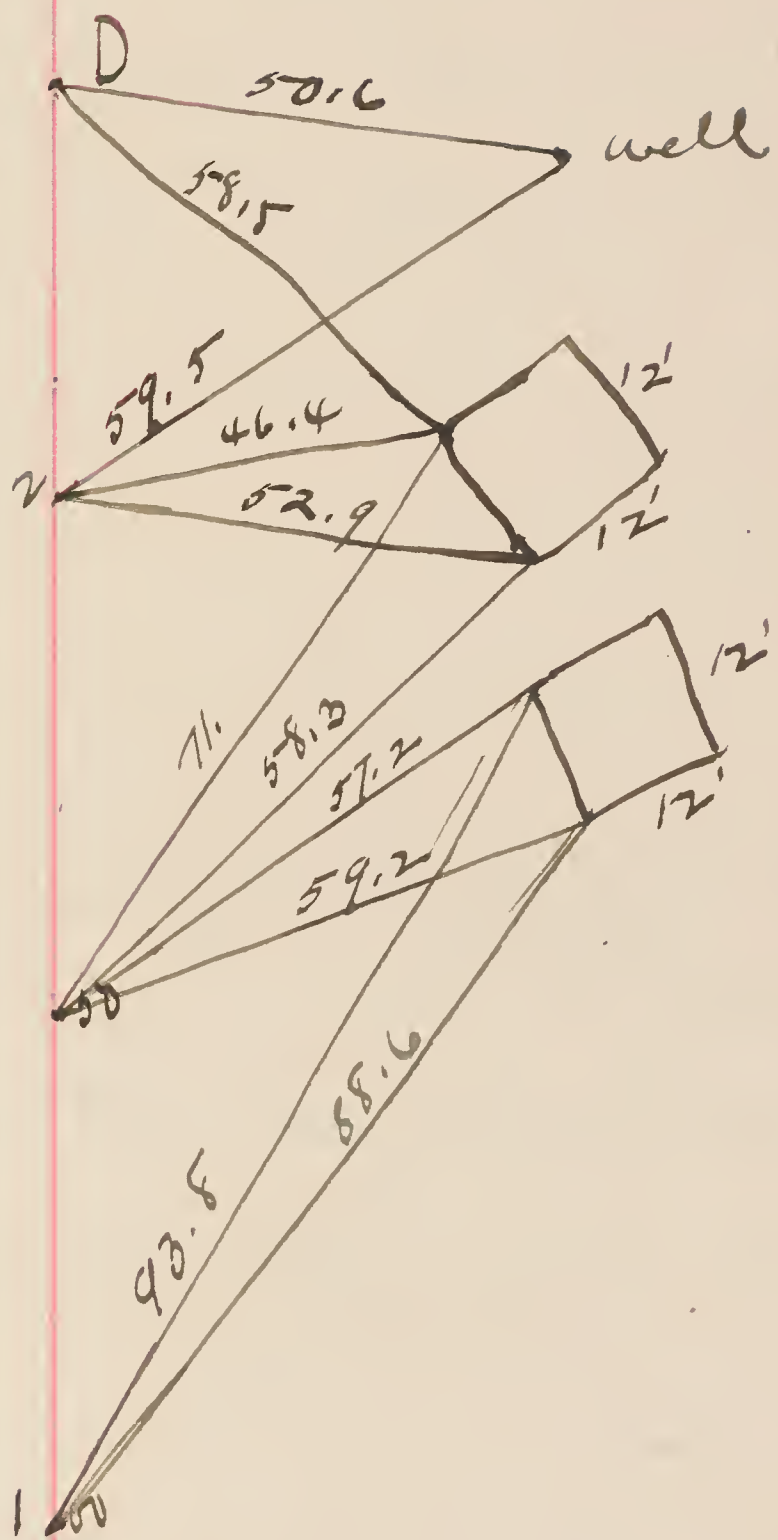
SW cor Chelster house 10.2 from D

South side of cut on railroad + 56.4

Center of South tracks + 47.3

Center of North track + 26.5

North side of cut on railroad
Station



Course $\approx A$.

Manhole in steam system

East of spruce and 95.1 from 300 and 99.8 from 200

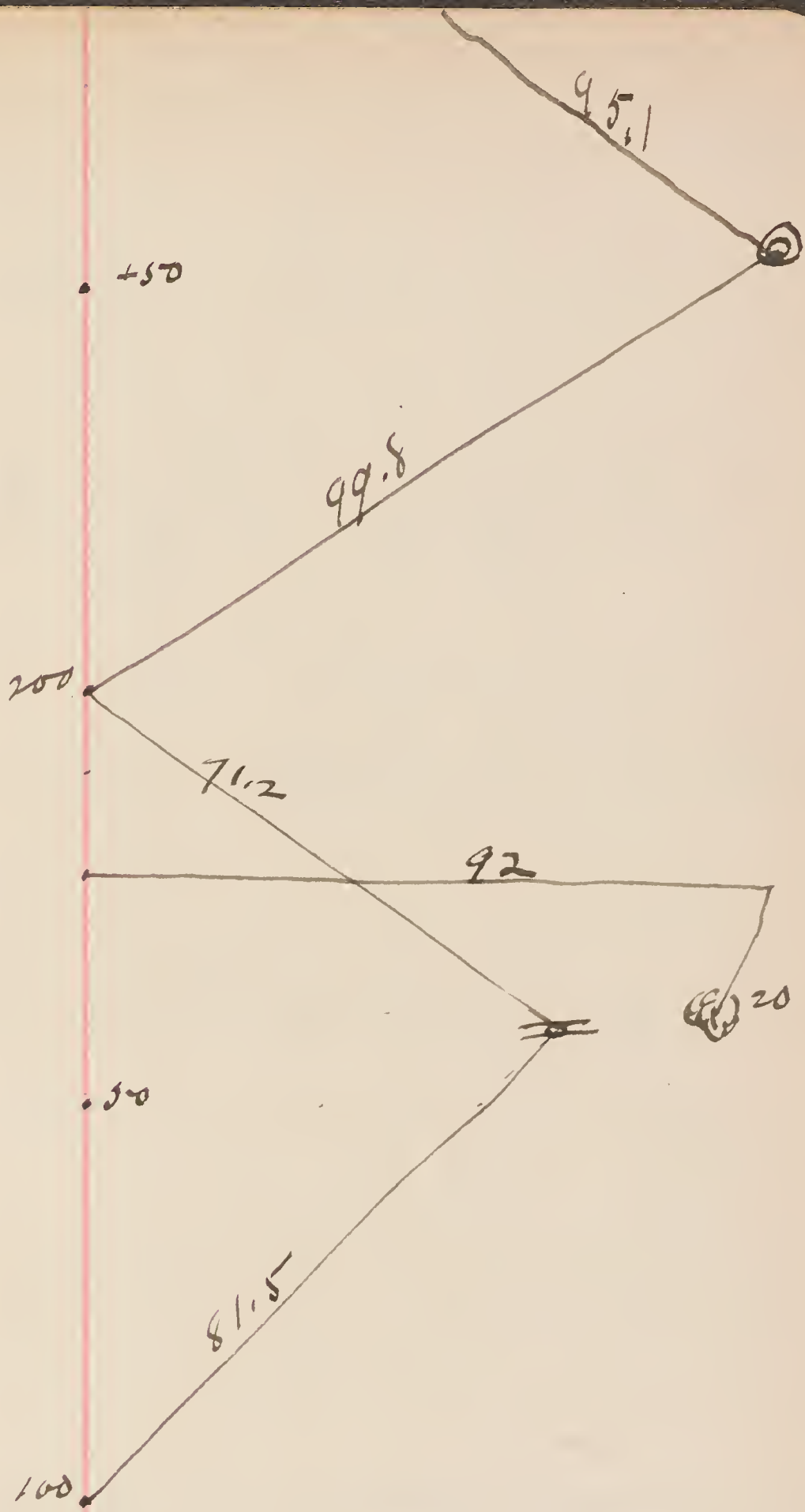
At 77 clump of spruce begins - extend N to walk
at 300 + 49

Telephone pole 71.2 from 200 and 81.5 from 100

100 center of road from rear of Wells to -
Baker House.

Center of river drive st + 40

Drive crosses R.R. tracks at its center at + 5
Station \approx



$+50$
 $+40$

$+8$
 ΔE

Road College Hall to Mech Lab.

Center of tracks 75' from 500

Road from Wells to Mech Lab. +25 and +10

at +49 line crosses center of walk Wells to Mech Lab.
Clump of Spruce which began at 100+7 ends
at +45 and 20' to right

500

200

+65

+51
50

+25

+13

200

~~+492.00~~

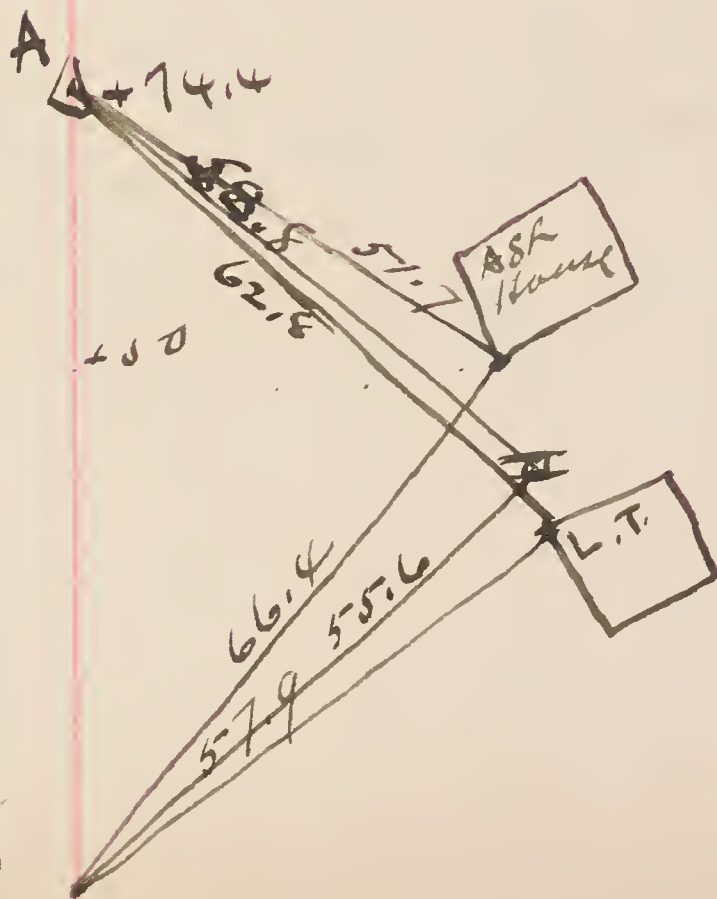
~~+45.23~~

300

200 + .50

S.W. cor ash house 57.8 from A and 66.4 from 500.
Telephone pole 58.8 from A and 65.6 from 500
N.W. cor Ladies Toilet 62.8 from A and 57.9 from 500.

520



Station	Bearing	Lat N	Lat S	E Def	W Def	Dis
A	S 89° 35' E		3.4	464.2		464.3
B	S 14° 38' W		471.2		123.	487'
C	S 34° 14' W		198.5		135	240'
D	N 71° 45' W	123.6			375.2	395.7
E	N 14° 46' E	549.5		169		575'
		673.1	673.1	633.2	633.2	

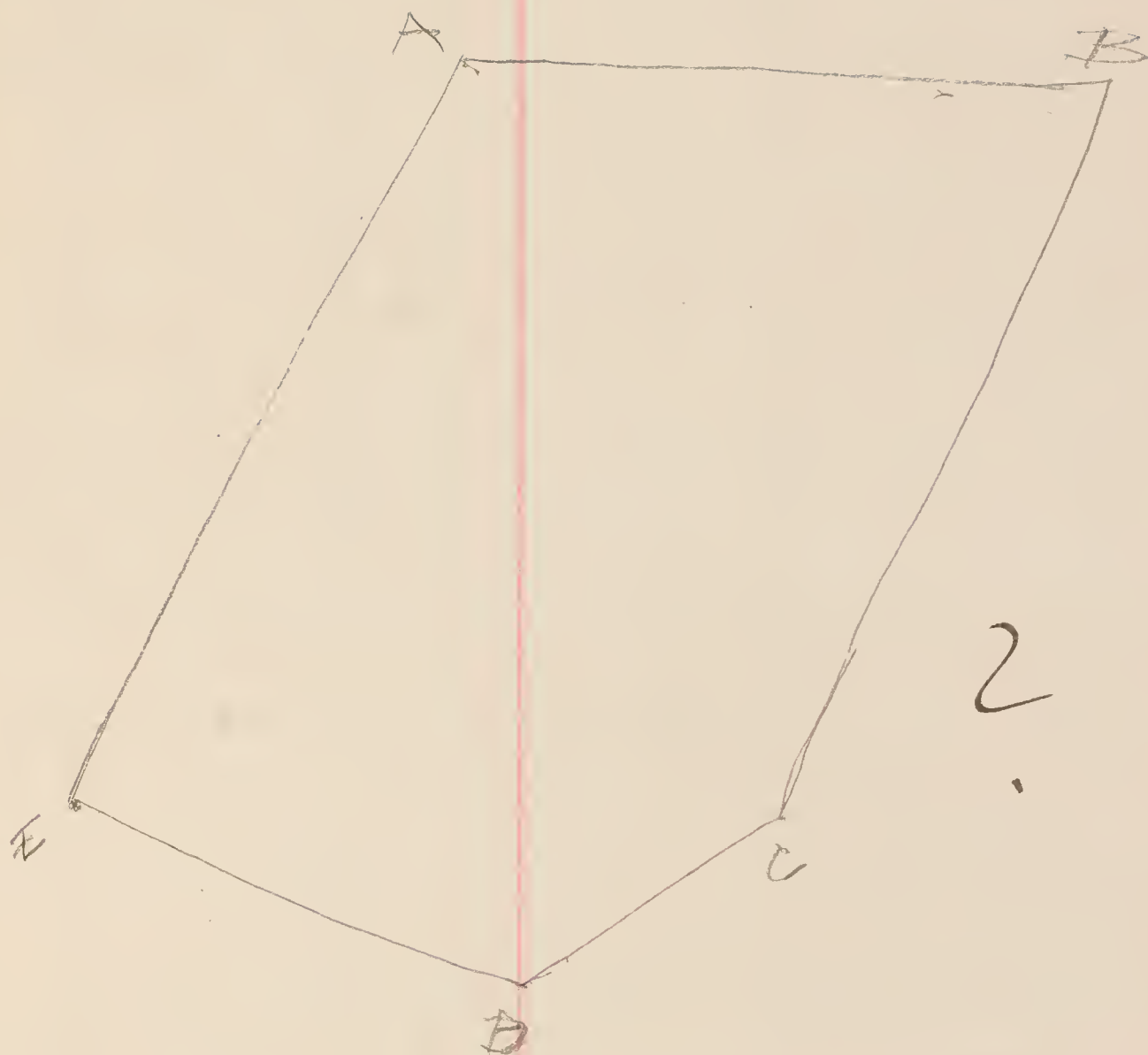
Bearings of this computation are referred to AB.

Sta.	Bearing	Lat.	Dep.	SMD	FW Dist.
BC	15° 47'	472.1	119.6	472.1	56462
CD	56° 11'	199.4	133.6	1143.6	152400
DE	72° 10'	121.3	376.1	2168.9	456980
CA	16° 41'	550.5	166.03	530.5	-91403

$$\begin{array}{r}
 2/575439 \\
 43560 \overline{) 287719.5} \overline{) 6.6+} \\
 \underline{261360} \\
 22359
 \end{array}$$

6.6 acres in flat.

$$\text{Error of closure} = \frac{\sqrt{(0.3)^2 + (0.8)^2}}{2161} = .00014$$



Examined, H. K. V.

+13 =

+3 =



△

Adjustment of the Compass.

I

Axis of socket must be perpendicular to plane of bubble tubes.

To verify: - Set up instrument and bring bubbles to centre of tubes. Turn plate 180° . If bubbles are still in centre axis is perpendicular to plane of bubble tubes. If not move plane until bubbles go half way back and repeat operation.

II

Plane of graduated plate to be perpendicular to axis of socket.

Test - irregular action in field gives difference in back and fore sights.

III

Needle point must be in centre.

Turn box until needle cuts points 180° apart, then again turn box 180° . The needle will be out maximum amount

bend needle $\frac{1}{2}$ back. This will
straighten needle. Test again

IV To set pivot. Needle being
straight, turn box until
needle cuts points 180° apart
Then turn box 90° and needle
will show maximum variations

V Set pivot, zero on scale, and
slits for sighting in same
vertical plane. Test by
silk card or loose hair.

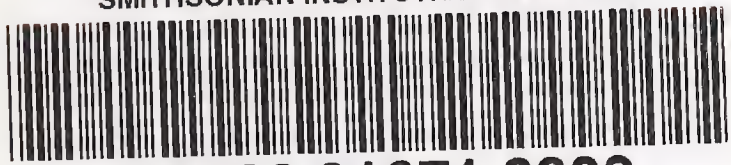
VI Slits for sights must, this
and their entire length lie
in plane normal to plane
of bubble tubes.

Test: Hang plumb line about 40 ft
away from instrument, and
sight on line. Putting eye at
bottom of slit and glancing
along length of other. repeat
this for both sights.

160	106° 41'	Q	a
	75° 49'	Q	B
	160		C
	105		D
	91		<u>E</u>

359° 25' E
 S 14° 38' W
 N 71° 05' W
 E 170° 6' E

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